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An Act of Faith in MODERN EQUIPMENT

The Allis-Chalmers Model U Tractor

A LITTLE over a year ago the Allis-Chalmers Manufacturing Company visioned a wide market for a tractor that would sell for less than $1,000 and at the same time would deliver most horsepower per dollar. With characteristic vigor, engineers of the company set to work and in less than a year designed and placed in production the Allis-Chalmers Model U tractor. Building to a price meant that details of design had to be tied up very closely with production practice, so that high quality would be maintained.

Tractors that are used on the farm, in construction work, and in industrial plants must meet severe service conditions and must stand up against all kinds of abuse. Because of this fact, and contrary to popular belief, the limits adhered to and the care exercised in building tractors are of the highest importance and compare favorably with the best automotive practice. Although, at the time, equipment was available at the West Allis Works which could have been pressed into service to handle the work, the desired combination of high quality and low price led the company to a bold decision. We decided that only the most modern production equipment would be used. Today every piece of equipment in our *new* tractor shop is itself brand *new!*

Imagine how any production man would feel when told to forget present facilities and to consider only new machines! Naturally, our men were enthusiastic, but a perusal of the following article describing the plant in detail will show that they did not let their imaginations run away with them. Every opportunity was given the machine tool builders to co-operate with suggestions, but it is a credit to our own production men that many ingenious short-cuts were proposed and put into practice by them.

By an investment of $2,000,000 in plant and equipment, we have staked our faith not only in the future industrial and agricultural prosperity of the country, but also in what modern equipment will do.

Otto H. Falk

President, Allis-Chalmers Manufacturing Company

ALL-MODERN EQUIPMENT

Produces Allis-Chalmers Tractor

By WILLIAM WATSON

General Works Manager,
Allis-Chalmers Manufacturing Company

Special-purpose equipment and tooling predominates in the new Allis-Chalmers plant designed for a production of 50 Model U tractors a day

WHEN engineers of the Allis-Chalmers Manufacturing Company set out to build a farm and industrial tractor that would sell for less than $1,000, they set themselves the task of building a machine that would develop most horsepower per dollar. It was realized at the start that such a result could be accomplished only through the use of the most modern types of production equipment. Hence when the production schedule was being prepared, no consideration was given to the use of any equipment then in the plant. Furthermore, the work was to be segregated from the rest of the works, in which was manufactured a diversified line of equipment ranging from small motors to huge turbines, largely in order to develop a personnel highly specialized in tractor production. Obviously, an entirely different kind of production thinking is needed in turning out tractors in quantity as against that needed, for example, for the work of fabricating a gyratory crusher, weighing hundreds of tons.

The design of such a tractor had to be tied up very definitely with the problem of economical manufacture. Every part was judged from this point of view. Certain key parts, such as the rear axle housing, were designed to be machined on equipment that with slight modifications can also be used for a shorter axle housing. As an additional precaution, two of the models developed on paper were built, torn apart, and criticized before any equipment was purchased for the new unit.

As a result of this investigation "Model U" was designed, developed, and placed in production within less than a year's time. Official tests at the University of Nebraska, give the motor a rating of 35 hp. at 1,200 r.p.m., full load, with 25 hp. at the drawbar. Four speeds forward are available on the rubber-tired model, three

Fig. 2—A group of Le Blond automatic lathes in the gear department of Allis-Chalmers' new tractor plant. Gears integral with shafts and gear blanks drilled, splined, and mounted on arbors are turned in these units, all featuring multiple tooling

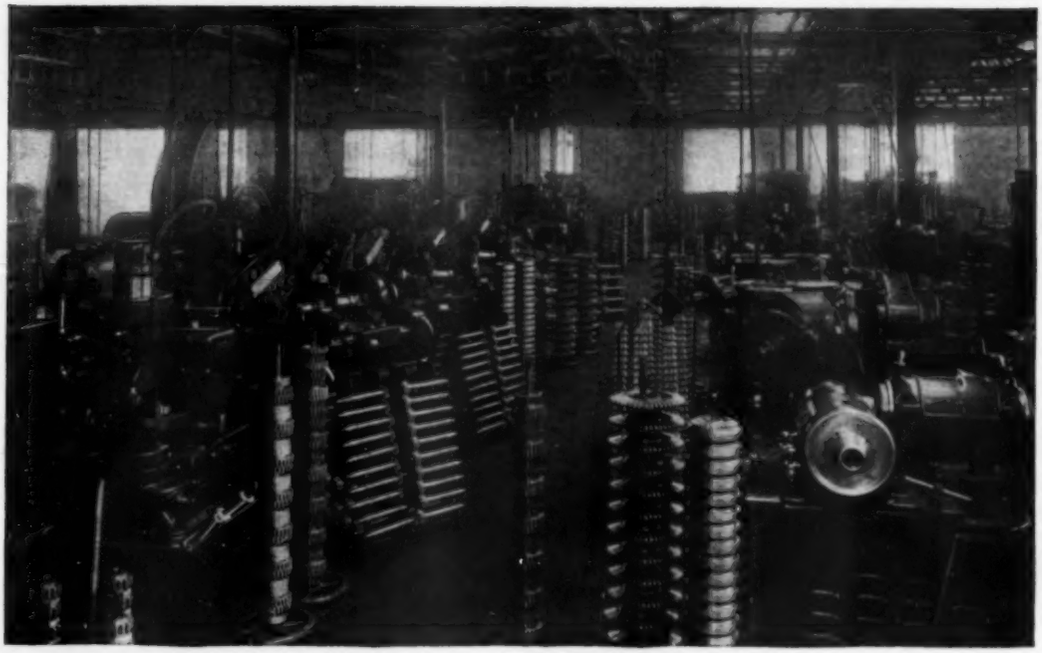


Fig. 3—Bevel gears and pinions, roughed on some of the Gould & Eberhardt machines in the background, are finished in this battery of Gleason gear cutters, of which there are seven. Inspection follows, including running-in against a master on a gear tester, shown in the right foreground

Fig. 4—A battery of Barber-Colman hobbers cutting cluster gears and splines on transmission jackshafts and rear axles. Larger machines are used for "Monarch" tractor parts, as are some Gould & Eberhardt hobbers. Finished gears are strung on spindles for transportation from operation to operation and to the heat-treating department in another building

otherwise, with a reverse speed also. Ready for the road, the tractor weighs approximately 4,700 lb. It is designed to pull three 14-in. bottom plows.

An initial production of 50 tractors a day was decided upon, with provision for expansion by the introduction of additional machines in certain key positions. About 160 machine tools were bought and installed in the new tractor building, which also includes assembly and some storage space. In addition to these purchases, an entirely new layout for this tractor production was made in the heat-treating department, housed in an adjacent building, and mechanical molding equipment was installed in the foundry to produce the two main castings. These are the transmission case and the rear axle housing, which, with the motor block, form the chassis of the vehicle. Hence, from start to finish, new equipment is used throughout. Among the chief parts manufactured in the plant are all gears and spline shafts, the two large, main castings, the front axle, the steering knuckles and steering links, and the gasoline tank. At present, gear and other forgings are purchased outside, but eventually these parts will also be produced in the plant with the aid of modern equipment now being installed. Other purchased items are wheels and steering gear units, as well as the motors.

In the purchase of new equipment, the question of delivery played no small part in the final decision. The matters of production time and, of course, price were also paramount. Considerable freedom was allowed the tool manufacturers in suggesting how a job could be done. Generally a blueprint of the part was supplied and the tool builder asked to suggest the type of equipment necessary. In other instances, Allis-Chalmers engineers demanded that certain operations, particularly on the large castings, be done in one set-up, because of their weight, and by dint of much effort succeeded in obtaining special-purpose equipment of somewhat unconventional design. In fact, in all but the gear department,

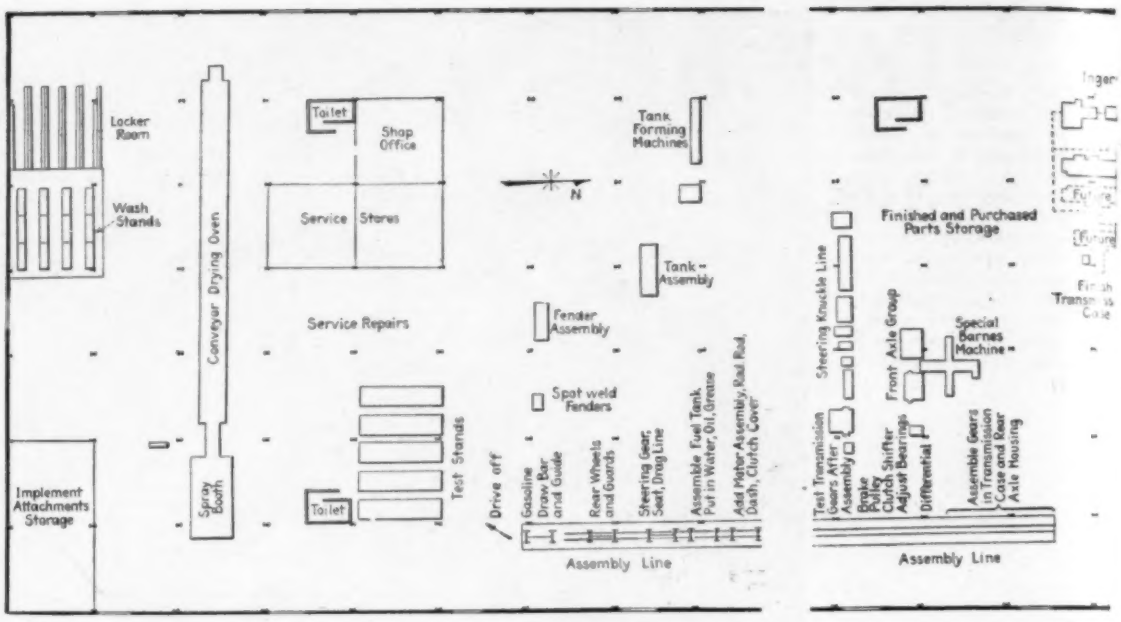


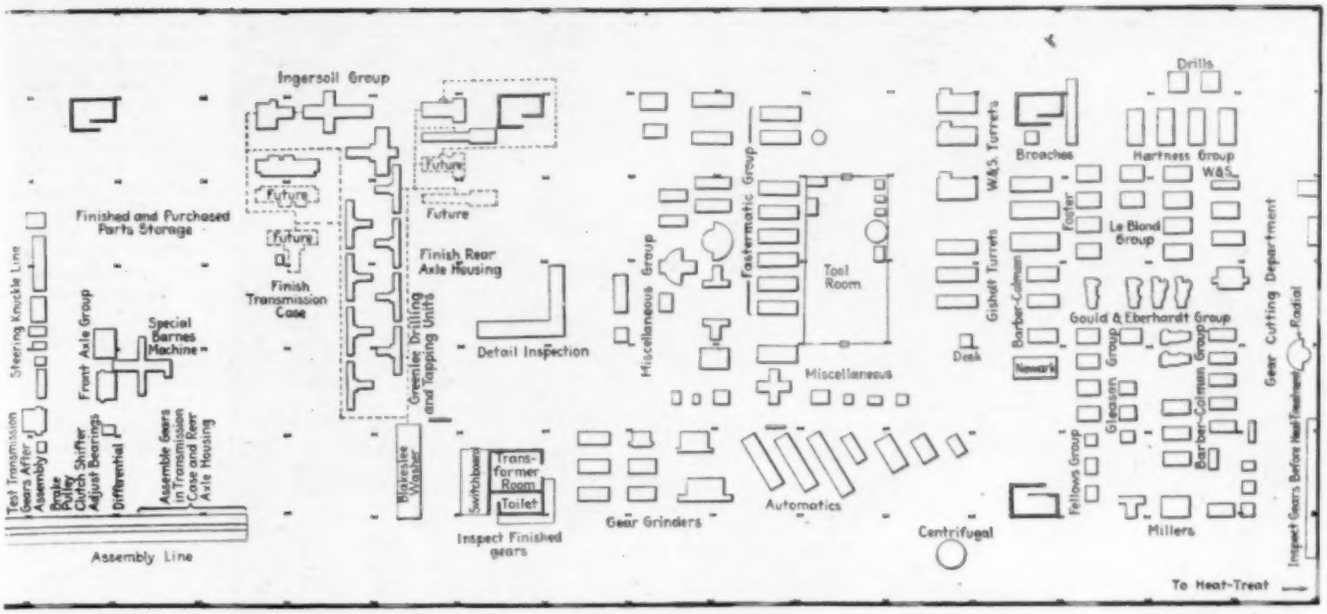
Fig. 1—Floor plan of the new Model U tractor plant of the Allis-Chalmers Manufacturing Company. In addition to the equipment shown, which is all new, modern heat-treating equipment has been installed in an adjacent building, and a mechanical molding and casting unit in the main foundry of the plant. An investment of close to $2,000,000 was made in machinery and buildings

Equipment Analysis

Gear Department

No.	Size and Make	Operations
	Drilling Units	
2	No. 4 Colburn	2⅜ and 1 11/16 in. holes in hubs of differential bevel and reverse idler gears, respectively
	Broaching	
1	Oilgear horizontal broach	Clear bores and cut keyway in fixed gears
1	American vertical broach	Cut splines in sliding gears in transmission, and in differential bevel gears
1	"General" arbor press	Mounting and dismounting gear blanks on splined arbors
	Turning Units	
2	No. 2L Gisholt turrets	Monarch tractor bevel gears
1	No. 3L Gisholt turrets	
2	No. 3A Warner & Swasey turrets	Large sprockets for Monarch tractors
1	No. 4A Warner & Swasey turrets	Large bevel gear for Monarch
1	No. 2A Warner & Swasey turrets	Boring and turning combination spur and bevel, 1st reduction gear—(Model U)
2	No. 4F Fastermatics (Foster) (Hannifin pneumatic chuck, Oilgear feed on turret slide and cross-slides)	Differential ring gears (United) (A) Turn O. D. and face both sides; (B) bore and put in clearance groove
4	Hartness 2-spindle flat turret lathes	United tractor gears. (A) Face and bore sliding gears; (B) face, and finish bore differential bevel pinions; (C) rebore, face, finish bore, and ream large differential bevels; (D) bore, turn, and thread cast-iron differential carrier adjusting nuts
7	12x6-in. LeBlond Multicut lathes	Face and turn sliding gears and bevel gears, mounted on splined arbors carried on centers; turn power take-off cross-shaft with integral bevel pinion; spline shaft turning; axle turning
3	12x7-in. LeBlond Multicut lathes	
1	16x7-in. LeBlond Multicut lathes	

No.	Size and Make	Operations
1	17x8-in. LeBlond heavy-duty engine lathe	Face differential pinions carried on splined arbor; general work on gears and axles
1	No. 6 Warner & Swasey turret lathe	Drill and tap ends of power take-off cross-shaft
1	Duplex Cincinnati Lincoln-type miller	Face ends of cross-shaft forgings
1	Sundstrand centering machine	Center ends of above
1	"General" flexible power press	Straighten above on centers
1	10x36-in. Landis cylindrical grinder	Rough grind seats on pulley pinion shafts, bevel gear shafts, and rear axles for fitting collor for mounting in gear cutting machines
1	Carlton 3-ft. radial	Miscellaneous drilling
	Gear Cutting Machine Group	
1	Large Newark gear cutter	Large sprockets for Monarch tractors
3	No. 17 Barber-Colman hobbers	(A) Ring gears, (B) spur gears for Monarch tractors
2	No. 36HS Gould & Eberhardt automatic gear hobbers	Monarch spur gears
2	No. 60B Gould & Eberhardt bevel gear cutters	(A) Single-spindle unit for large bevel gears for Monarch tractor; (B) three-spindle unit for medium-size bevel pinions for both models
2	No. 36 BM Gould & Eberhardt automatic gear cutters (2-spindle)	(A) Rough cutting differential bevel pinions; (B) cut bevel gear of 1st reduction unit (combination spur and bevel)
3	No. 16 Barber-Colman hobbers	Spur gears for Model U tractors
5	No. 12 Barber-Colman hobbers	Splines in transmission countershaft and on rear axle halves
5	No. 12 Gleason bevel gear-finishing machines	Bevel gears and pinions for Model U and Monarch
2	No. 8 Gleason high-speed bevel pinion finishers	Differential bevel pinions, both models
1	18-in. Gleason bevel gear tester	Inspect
1	No. 7A Fellows high-speed gear shaper (510-1,620 strokes per min.)	Cut internal teeth on clutch gear



No.	Size and Make	Operations
2	No. 6A Fellows shapers	(A) Internal teeth on large Monarch clutch gear; (B) couplings halves for Monarch tractor
1	No. 2 Milwaukee miller, duplex cutters	Mill clutch teeth in hub of clutch shaft pinion
1	No. 33 Kempsmith miller	Cut keyway on transmission jackshaft
1	14-in. Leland-Gifford 2-spindle drill	Drill and burr oil holes in gear rims
2	Peerless chamfering machines (Pneumatic chucks)	Round teeth of sliding gears
1	Lees-Bradner thread miller	Cut threads on rear axles
1	Adams gear tester	Inspect spur gears
1	Taylor & Fenn spline miller	Spline work on shafts

Screw Machines

1	⅞-in. 4-spindle Cone automatic	
1	1¼-in. 4-spindle Cone automatic	
1	2¼-in. 4-spindle Cone automatic	Small parts, differential studs, etc.
1	⅝-in. Cleveland automatic	
1	1½-in. Cleveland automatic	
1	2½-in. Cleveland automatic	
1	4½-in. Cleveland automatic	
1	4¼-in. Gridley automatic	
1	3-unit Kingsbury drill	Drill cotter-pin holes in differential studs and clamp bolts, etc.
1	3-unit H & G threading head	Threading above parts, etc.
1	Kempsmith hand miller	Mill keyway in above parts
1	Colt Autosan washer for small gears and screw machine products	

General Manufacturing Section

1	W.F. & J. Barnes Special 4-way turning unit	Turn and center differential spider
2	4-spindle Leland-Gifford drills	Drill three holes in radius rod (wishbone) and tap one, etc.
1	1-spindle Leland-Gifford drill	Drill shifter rod (transmission)
1	Kempsmith hand miller	Mill keyway in steering spindle arm

No.	Size and Make	Operations
1	No. 33 Kempsmith miller	Miscellaneous milling operations
2	No. 2 Milwaukee millers. One with indexing fixture	(A) Mill clutch on spur pinion; (B) miscellaneous milling operations
4	No. 2F Fastermatics (Foster)	(A) Cast-iron parts; (B) forged-steel differential hubs
1	No. 3F Fastermatics	
1	No. 1F Fastermatic (Special tooling)	Clutch bracket and clutch shifter yoke
1	No. 3F Fastermatic	Transmission case head only
1	No. 3F Fastermatic without turret, but with single tool carried in turret position, with cam control on overarm	Power take-off pulley

(Note: All Fastermatics are equipped with Oilgear feed on the cross slides and turret, Hannifin pneumatic chucks, and Allis-Chalmers Texrope drives.)

1	No. 1L Gisholt turret lathe	Turn and face differential bearing holders
1	W.F. & J. Barnes special boring unit	(A) Rough and finish bore, ream, and thread transmission case head; (B) drill and finish ream three holes in head
2	Fox adjustable, multiple-spindle drills, hydraulic feed	(A) Drill differential hubs; (B) drill large Monarch sprockets, etc.
1	3-ft. Carlton radial	Drill and tap hole in transmission cover; miscellaneous
1	5-ft. Western radial	Drilling, tapping, spot facing
1	4-spindle Leland-Gifford drill	Miscellaneous operations
1	No. 6 Gardiner disk grinder with fixtures on swing arms	Face-grind steering gear bracket, air cleaner base, exhaust elbow, etc.
1	36-in. Blanchard surface grinder	Small, flat work

Gear Grinding

3	No. 72A-3 Heald internal grinders, pneumatic chucks	Grind internal bores of sliding gears
2	Large Heald internal grinders	Grind Monarch and Model U ring gears internally
1	6x30-in. Landis cylindrical grinder	Shaft work, transmission countershafts, power take-off, constant mesh gear
1	14x36-in. Cincinnati cylindrical grinder	

Fig. 5 — Miscellaneous cast-iron parts and one steel part are finished on these Fastermatics, featuring Oilgear feed on the turret head and pneumatic chucking. Behind the wire screen is the toolroom where all the cutter grinders are grouped

No.	Size and Make	Operations
1	10x48-in. Landis grinder	Grind rear axles, etc.
	Rear Axle Housing	
1	Special Ingersoll boring and milling machine	Face and bore rear end, bore and face front end
1	Special Ingersoll boring machine	Bore main bearing and differential bearing carrier seats
1	Greenlee hydraulic drilling unit, opposed heads	Drill 31 holes front and back
1	Greenlee 3-way hydraulic drilling unit	Drill 10 holes for axle cover plates, and 3 in top
2	Greenlee opposed-head, multiple-spindle tapping units	Tap above holes
	Transmission Case	
1	42x28-in.x8-ft. Ingersoll planer-type miller, screw-feed, 6 cutters	Mill two ends and cover
1	30x48-in. Ingersoll duplex miller, hydraulic feed, 3 cutters	Mill pads on side
1	Special Ingersoll opposed-head boring machine, Oilgear feed	Bore and face large internal diameters
1	Special Ingersoll 3-way boring unit with tapping attachment	Cross bore three 6-in. holes; bore, ream, and tap one 5½-in. hole
1	Greenlee 3-way, multiple spindle drilling unit, Oilgear feed	Drill 42 holes in ends and one side of case
1	Greenlee 3-way, multiple-spindle tapping unit (lead screw)	Tap 24 holes drilled as above
1	Greenlee opposed-head, multiple-spindle drilling unit (Oilgear)	Drill 41 holes in sides of case
1	Greenlee opposed-head, multiple-spindle tapping unit (lead screw)	Tap 24 holes as of above and ream 3
1	Niagara Washer	Wash castings
	Front Axle and Steering Knuckle	
1	No. 33 Kempsmith miller, indexing fixture	Straddle mill both ends of front axles
1	Special W.F. & J. Barnes machine, two 20-in vertical single-purpose production drills and one 5-spindle horizontal unit head with hydraulic feed	Drill five holes in side of axle, and drill and ream kingpin holes
1	No. 3 Rigidmil (Sundstrand)	Straddle mill steering knuckle yokes
1	Special W.F. & J. Barnes horizontal, opposed-head drilling unit with rotary fixture	Drill, ream, and finish ream kingpin holes in knuckle
1	12x7-in. LeBlond Multi-Cut lathe	Turn four diameters and shoulders on wheel spindle of knuckle
1	No. 9 Natco-Minster drill, single-spindle	Drill hole in knuckle for steering arm
2	2-spindle Leland-Gifford drill	Drill cotter-pin hole and oil hole in knuckle
1	Cincinnati high-speed tapper	Tap oil fitting hole
1	14x18-in. Cincinnati cylindrical grinder	Grind bearing seats on wheel spindle
1	8-ton "General" flexible power press	Broach keyway in steering arm hole; assemble gears on shafts, etc.
1	4-ton "General" flexible power press	Press on bearing races, assemble small bushings, etc.
1	No. 4 Warner & Swasey turret lathe	Odd jobs, including threading of shifter rod and forming ball at other end
1	W.F. & J. Barnes Special 4-way drilling unit with three sets of tools	Drill, ream, and finish ream four bearing holes in cast-iron differential carrier
1	Reichert spot welder	Weld fenders
1	Special Stolp forming and seaming machine	Form and bead joint of gasoline tank from sheet stock
1	American Can Co. heading unit	Bead and roll in heads of gasoline tank
1	De Vilbiss paint spraying booth and dryer oven with conveyor.	Paint and dry tractor unit
	Tool Room	
1	Gleason gear-cutter-tooth grinder	
2	Oliver drill grinders	
1	14-in. Cincinnati reamer grinder	Keep all tools in sharpened condition
1	Barber--Colman hob grinder	
1	Internal cutter grinder	

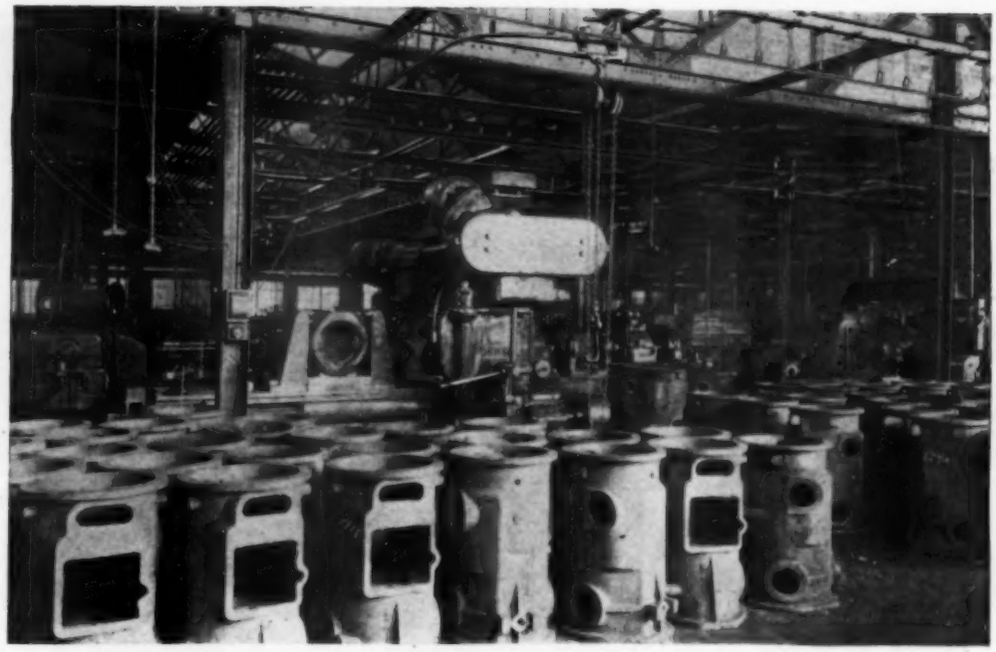


Fig. 6—One of the features of this group of special-purpose Ingersoll machines is the fact that a number of operations are performed on the two main castings in a single set-up. The castings shown weigh about 450 lb., and transportation between machines is by chain blocks suspended from overhead monorails

in which, by the way, the far greater portion of equipment is concentrated, special-purpose equipment predominates. Because of this condition, the visitor to the plant is impressed with the fewness of the operators and the lack of any feverish activity on their part. Views of crowded machinery with men working elbow to elbow are entirely absent, but the floor space is utilized efficiently.

After the number, size, and make of each machine had been selected, a floor plan was drawn to the scale of $\frac{1}{4}$ in. to the foot, and the approximate location of each unit was determined with the aid of cardboard cutouts to the same scale. As an added precaution, full-scale floor-space templets, constructed out of 1x4-in. wood strips, were experimented with on the factory floor until a satisfactory arrangement was found. This procedure assured the management that most effective use would be made of the floor space before a single machine was installed.

As mentioned previously, with the exception of the

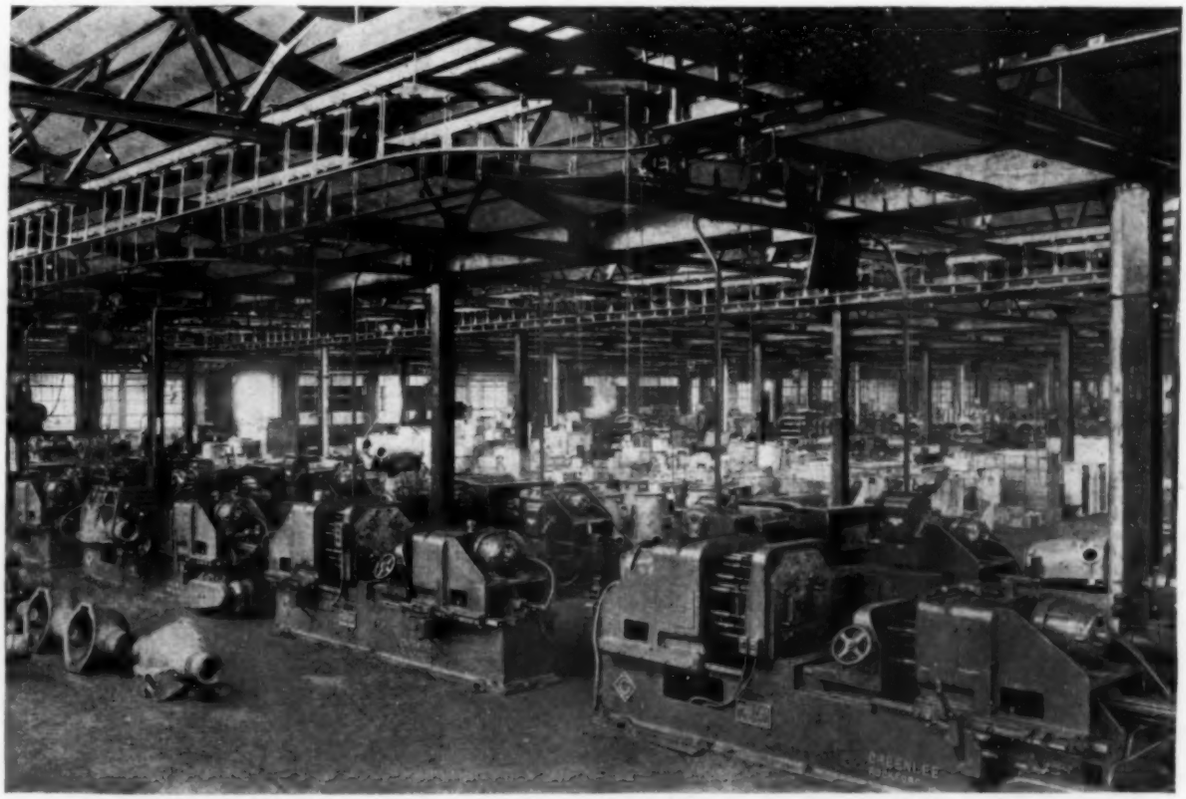


Fig. 7—A battery of eight Greenlee multiple-spindle drilling and tapping units. Four machines are found in each line: one for the rear axle housing, several of which are shown at the left, and the other for the transmission case

Fig. 8—In this line-up, the drop-forged steering knuckle is completely machined. After being straddle milled, it is drilled and reamed, the spindle turned, the steering arm boss drilled and reamed, the spindle threaded and finally ground. About 18 pieces are completed an hour

Fig. 9—The tractor unit is completely assembled as it travels down this line. The two main castings, carried in cradles, are assembled as units before being bolted together and to the motors stored at the left. Finished parts are stored alongside. Rear wheels, front axles with wheels, gasoline tank, radiators, seats, and miscellaneous items are put on at the far end

heat-treating installation and the foundry layout, all other equipment is housed under one roof, as shown in Fig. 1. The building itself measures 180x602 ft., and is of brick and steel construction. Its size was determined after a general selection had been made of all machine tools and related equipment. Steel-frame windows line the side walls, while the roof is of saw-tooth form with northern exposure for the roof windows. Gypsum slabs, about 4 in. thick, line the underside of the roof and insulate the shop from the cold of winter and the heat of summer. Asphalt-impregnated wood blocks laid over a concrete base form the floor. Hot water is used for heating, and the pipes are placed along the walls and under the roof windows. Lighting is by 300-watt lamps placed in enameled steel reflectors on 16-ft. centers at a height of 12 ft. from the floor. In certain locations

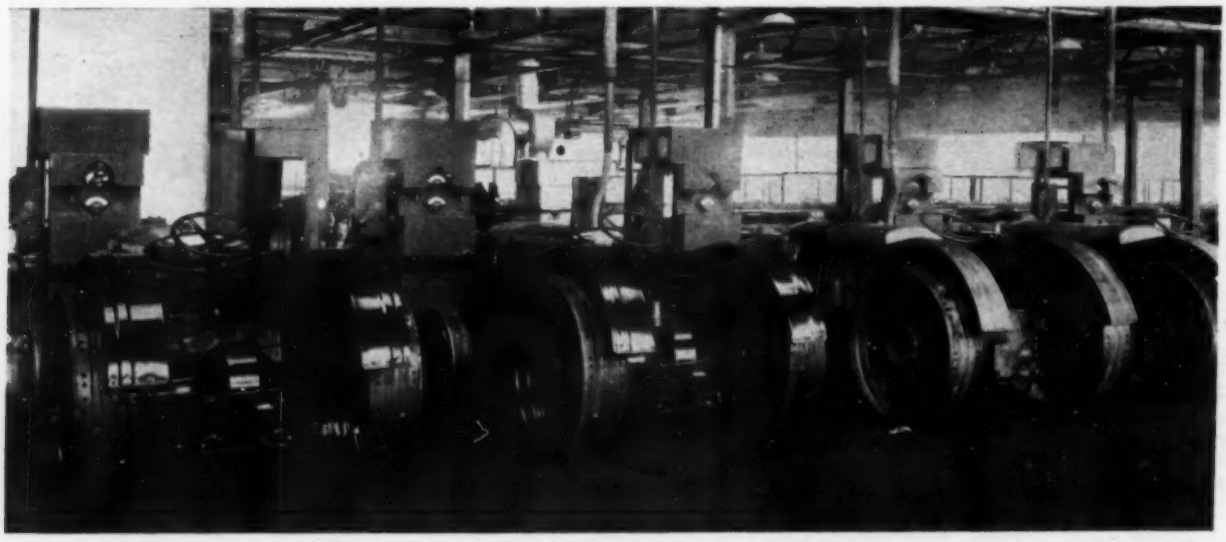


Fig. 10—Each tractor is filled with automatically measured quantities of oil, gasoline, and water, and driven to the test stands shown. Connection to the five 27-kw. generators is by belt from the power take-off pulley

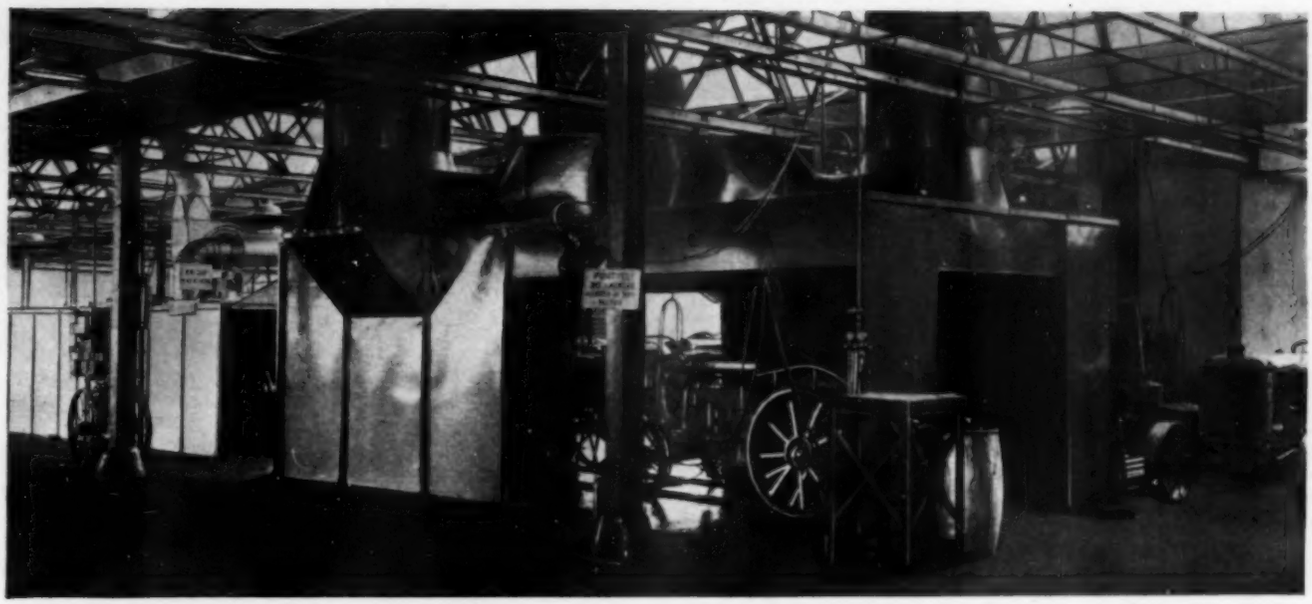


Fig. 11—After being thoroughly tested under full load the tractors are driven from the adjacent test stands to the spray booth shown, where, after cleaning, a distinctive Persian orange paint is sprayed on, then dried in the tunnel

500-watt lamps are employed in the same reflectors.

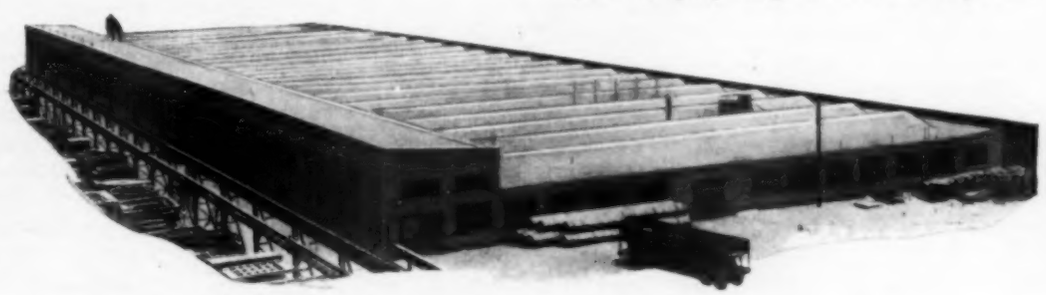
Except for two internal grinders, every machine installed has self-contained motor drive, and except for those applications where the motor is built directly into the head, Texrope drive is universally employed. Allis-Chalmers anti-friction a.c. motors are used throughout. Pneumatic chucking has been applied almost universally, and air clamping is used on the radial drills. Oilgear feed has been favored on all logical applications, including a number of late-model turret lathes. Wherever possible, also, the question of lubrication was solved by the use of some form of lubricator.

Transportation of parts between machines and to the assembly division is almost entirely by means of a Louden over-head monorail system, interconnected with switchover points. Chain blocks are run on these lines, with the exception of some of the heavy lines running out to the freight car siding, in which case 1-ton electric hoists are operated from the monorail. For ease in handling, gears are stacked on long arbors; shafts, either with or without integral pinions, are carried in special racks built of sheet steel welded together. Certain small parts used in assembly are trucked in tote bins.

As can be seen in Fig. 1, the gear cutting department is at the north end of the building and the assembly, test, and finishing lines at the south end. In the gear cutting department the rough forgings enter at the west side and leave at the east side where the finished gears are brought to the washing machines and eventually to the heat-treating department, housed in a separate building. First come the drills and turret lathes for drilling, boring, and facing the blanks, then the automatic lathes for turning, followed by the rough gear cutters, the finish gear cutters, and the gear testing equipment. In this department, besides all the gears and spline shafts for the United tractor, there is also cut all the gears and sprockets of the Monarch tractor, mentioned previously. Figs. 2, 3, and 4 show various views of this department.

Miscellaneous operations on small cast-iron parts are performed in the section shown in Fig. 5 just south of the toolroom. To the east of it is the screw machine section. A wide space now used for inspection of finished parts and storage of rough castings separates this end of the shop, in which most of the equipment is concentrated, from the section in which the transmission case and the rear axle housing castings are finished. In another article the detailed operations on the castings are described. Suffice it to say at this point that, in general, special-purpose milling and boring machines, shown in Fig. 6, are employed in conjunction with a battery of eight multiple-spindle drilling and tapping units, some of which are seen in Fig. 7. Altogether there are fourteen machines in this group, attended by six operators.

Further south in the shop and also separated from other units by storage space of finished parts ready for assembly is another group of machine tools, Fig. 8, employed chiefly in finishing the front axle and steering knuckle forgings. In the same vicinity are two tank forming machines and the wheel guard assembly department. To the east is the assembly line, Fig. 9, and to the south the test stands where the tractors are operated under electric dynamometer load, as pictured in Fig. 10. At the extreme south end of the shop is the paint spray and drying equipment, Fig. 11, surrounded by sufficient space for preparing tractors for shipment.



· BOOK · REVIEWS ·

THOMAS DAVENPORT, *The "Brandon Blacksmith," Inventor of the Electric Motor, a Biography. By Walter Rice Davenport, D.D. One hundred seventy pages, 6x9-in. cloth boards. Illustrated. Published by The Vermont Historical Society, Montpelier, Vt. For sale through the author, 67 East State Street, Montpelier, Vt. Price $2.*

THIS work is a belated recognition of Thomas Davenport, the inventor of the electric motor. Although, as the author confesses, it is very frankly an appreciation by one member of a family for another member, it may be read with interest and profit by anyone interested in the invention of the electric motor and its inventor. James Hartness says in a short introduction, Davenport "was far in advance of his time and his untimely death with no public recognition of the real worth of his invention is a sad tale. The present age enjoys the benefits of his work far beyond anything he could have imagined, and his immortal discovery will increasingly benefit the age and the races." That the U. S. patent for the electric motor was issued in 1837 and that a printing press was electrically driven in 1839 will come as two surprises among many recounted and authenticated by the author.

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MATERIAL CONTROL AND STORESKEEPING IN MACHINE SHOPS AND FOUNDRIES. *By Willis Wisler. Two hundred eighty-four 8x11-in. pages. Cloth bound covers. Issued as a special bulletin by the Bureau of Business Administration, Ohio State University, Ohio State University Press, Columbus, Ohio.*

TO QUOTE the preface, "This study consists largely of a series of case studies of Ohio manufacturing concerns selected with respect to routines in effect in handling material in process of manufacture."

The nine different companies selected represent a fair cross-section of the manufacturing industry of Ohio. Some of the concerns are large, others are small. Some have foundries, some have not. The methods and routine of some are modern. Others, not so much so. The foundry is studied as a unit of a plant, and as an independent enterprise.

The studies cover several years, and the classes of material handled may be judged from the following list of the chief articles of manufacture: sanitary equipment, locomotive cranes, bridges, and hydraulic presses; plumbing fixtures, electric utensils, and gas engines; mining and conveying machinery, steam shovels and castings.

The studies show every evidence of intelligent analysis and comparison. The author also points out the increasing use of control charts, but finds that "all of the graphic control devices had to do with the physical movement of material rather than with furnishing bases for managerial decision."

The deductions drawn from the cases reviewed can also be quoted from the book. "1. The essential importance of material as a major factor in industry. 2. Integration of material control with production control. 3. Simplification of material control routine and forms. 4. The abandonment of formally fixed maximum and minimum limit. 5. The absorption of storeskeeping into transport through work-in-process. 6. Material in continuous flow provides-in its own physical movement—its necessary control.

✻

THE BALANCING OF ENGINES. FOURTH EDITION. *By W. E. Dalby, professor of engineering, Imperial College of Science and Technology, London. Three hundred twenty-one 6x9-in. pages. Cloth board covers. Two hundred eighteen illustrations. Published by Longmans, Green & Company, New York, N. Y. Price $8.40.*

THE book is not intended as a treatise on practical balancing, and does not take up the subject of balancing machines. It is a thorough mathematical discussion of the theory of balancing and its calculation and layout on the drafting board. Though intended primarily for designers, the volume will be found useful to any production man who is looking for a background of the subject and is grounded in college mathematics.

Graphical methods of balancing, revolving and reciprocating parts are given, together with methods of accounting for unbalance, couples, turning moment, vibration, and other factors. The book is well illustrated with 218 figures, and many typical examples are worked out. Beside the data on the balancing of engines and locomotives, a chapter has been added on the vibration in railroad bridges set up by unbalance in locomotives.

✻

AIRPLANE MECHANICS RIGGING HANDBOOK. *By Rutherford S. Hartz and Elzor E. Hall. Published by The Ronald Press Company, 15 East 26th St., New York, N. Y. Two hundred sixty-four pages, 5¾x8¼ in. Indexed. One hundred and four illustrations. Cloth bound. Price $3.50.*

THIS is a manual of daily operating practice, covering the rigging, maintenance, inspection, and repair of airplanes, written by a former Lt. Col. of the Air Corps, U. S. Army, in collaboration with a Lieut., Air Corps Res., formerly Aviation Sec., S. C., U. S. Army. It tells those responsible for safe and efficient operation how to get an airplane into flying condition and how to keep it that way. It explains thoroughly the technique of the work of the airplane mechanic and stresses the need for care, accuracy, and thoughtfulness on his part.

The language is non-technical, and theory has been omitted. Instructions are given in detail, showing how each operation should be done, the order, and the reasons why. Many hints about correct practice and warnings of wrong practice add to its usefulness. In addition to telling about rigging and "trouble-shooting" an airplane, the authors have arranged a mass of information about fabrics, wood parts, metal fittings, wire, and dopes and doping. More than 600 questions typical of Department of Commerce questions are listed at the ends of the various chapters. It is a text written for the airplane mechanic himself, but may prove useful to mechanics in automotive and other fields, as well as presenting a number of shop "kinks" that might readily be adopted.

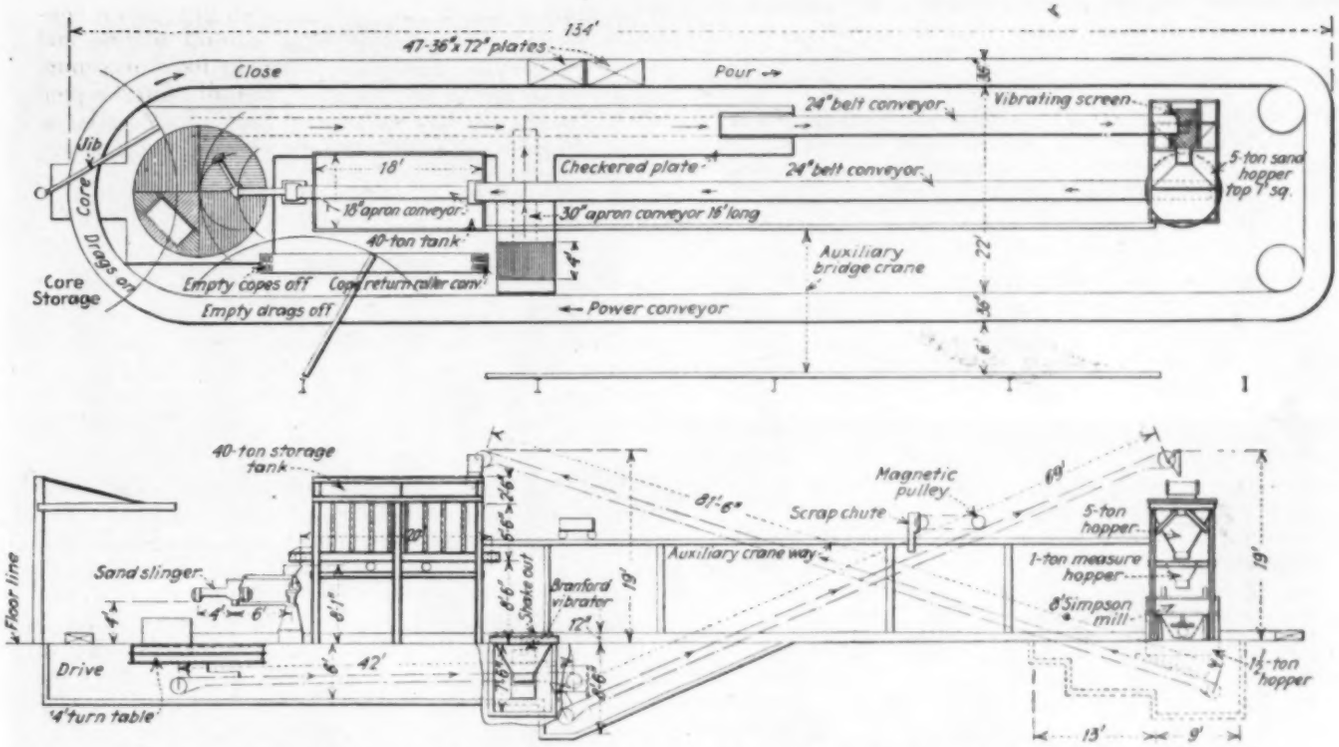


Fig. 1—Elevation and floor plan of the mechanical installation in the Allis-Chalmer's foundry for molding, casting, cooling, and dumping the two main Model U tractor castings. The continuously-operating sand tempering unit is also shown

Completely Mechanized Foundry for Tractor Castings

By E. A. HARRISON

General Superintendent of Foundry and Pattern Shops
Allis-Chalmers Manufacturing Company

LIKE the rest of the Allis-Chalmers model U tractor production units, the foundry layout is designed for a normal daily production of 50 of each of the two main castings, which weigh 350 and 450 lbs., respectively. By increasing the speed of the conveyor units, which are driven through a Reeves variable-speed drive, this production can be increased to about 60 castings each, or 120 per day of eight hours. In fact, the actual production guarantee of the unit is 20 molds per hour.

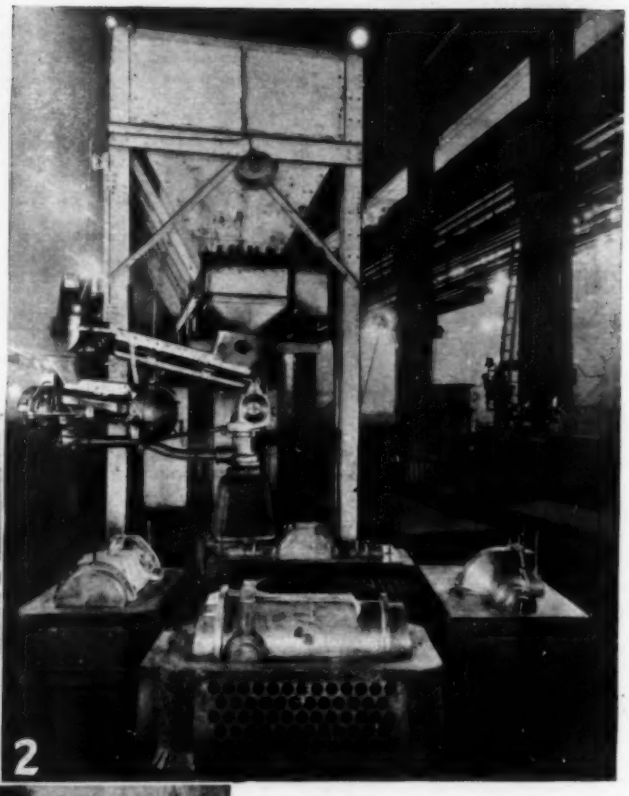
Here again, as in other parts of the plant, mechanization has been used to reduce the number of workers ordinarily employed. For example, only ten men are required on this foundry unit to maintain the given production, including those necessary to operate the sand tempering equipment, which, however, is almost entirely automatic in operation. Seven men are placed at the molding end of the line; three of them on the molding unit proper, one putting on flasks, another setting cores, and two others clamping the flasks and making up runner boxes. Two other men dump the flasks and remove the castings, while the tenth man is stationed at the sand tempering mill.

Besides obtaining an increase in production with a decrease in the number of employees, there is considerable saving in floor space and in the number of patterns ordinarily required to obtain such a production. Another feature is the fact that the entire unit, except the cupola, is self-contained, and hence gives an appearance of neatness and orderliness to a part of the shop that in many foundries resembles No Man's Land after a heavy barrage.

In Fig. 1 is shown the floor plan and elevation of the molding and casting units as well as the sand tempering equipment. A completely mechanized core molding and baking unit and a casting washing machine, not shown, are also part of the tractor foundry layout. The photographs, Figs. 2, 3, and 4, give detailed views of certain parts of the conveyors for the flasks and the continuous

Fig. 2—Close-up of the turntable of the molding unit showing the two pattern halves for the transmission case and the rear axle housing of the Model U tractor. The turntable revolves slowly while the mold is prepared with the aid of the sand slinger shown in the background just below the green-sand storage hopper

Photographs and drawing of the molding and casting unit by courtesy of the Beardsley and Piper Company, Chicago.



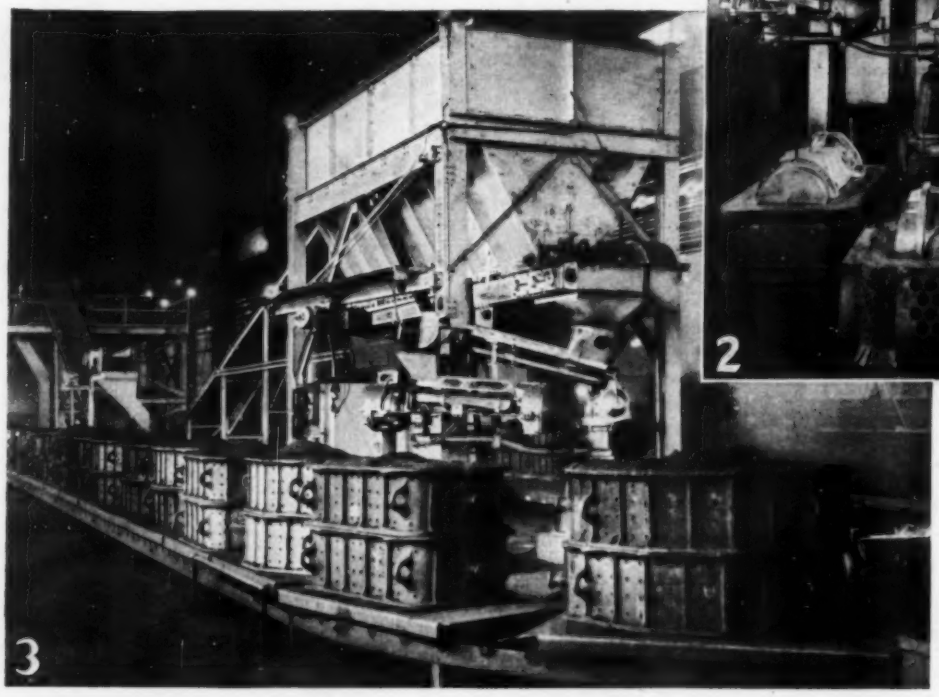


Fig. 3—Flasks ready for pouring, with the exception of final work on the runner boxes. To the right, just out of this picture, the cores are assembled in the drags and the copes lowered in position by means of an overhead bridge crane

sand tempering system. Fig. 2, for example, shows the four metal pattern halves from which two complete molds can be made. The patterns are permanently mounted on four stripping plate machines operated by air and carried on the grid of a slowly revolving table. In this view, the empty flasks come down the flat conveyor at the right, and by means of an overhead bridge crane, are removed to the roller conveyor immediately adjacent where they are held in temporary storage.

When needed, the cope or the drag is lifted by the same overhead crane and placed over the metal pattern on the molding turntable. The sand slinger, shown at the rear in Fig. 2, then deposits the molding sand around the pattern and in the flask. With this method, sand is deposited in such a manner that it is well rammed and properly ventilated, so that no mechanical venting is necessary. The sides of the flasks themselves are honeycombed with holes, also for the purpose of venting the mold.

When the drag has been molded, with the aid of the overhead crane, it is picked up by its trunnions at the side, is turned over and placed on one of the flat plates on the conveyor which surrounds the entire unit. These plates measure 36x72 in., the flasks being 34x65 in., approximate overall dimensions. The cores, made in an adjacent bay, are stored alongside the flask conveyor at this end, and by means of an overhead jib crane are lowered into the drag half of the molds. Afterward the cope is assembled in place by the same overhead bridge crane mentioned previously. Making the runner boxes is done by hand as the flasks move around to the pouring position.

The cupola is located to the left of the pouring line shown in Fig. 3, and is served by a 3,000-lb. ladle, from which five molds may be cast. Pouring takes place while the flasks slowly move along the conveyor line. They are also allowed to cool on this line until they reach the shake-out shown near the sand storage bins in Fig. 1. At this point the overhead bridge crane lifts the flasks off the conveyor and places them on the grate of a 5-in. Branford vibrator where all of the molding sand is shaken loose. The flasks are then removed and the castings loaded on flat steel plates alongside from where they are later conveyed to the power washing machine. Fifteen transmission cases can be laid on one carrier plate in a horizontal position, whereas the rear axle housings are set vertically in twelve circular pockets perforated in special carrier plates. Not until the castings have been completely washed and are ready for the cleaning room do they leave these plates.

Underneath this shake-out is a 30-in. apron conveyor which takes the sand across to a 24-in. belt conveyor,

which in turn elevates the sand to a vibrating screen. On the way up, the sand passes under a lump breaker and, further up, a magnetic pulley, by means of which all the iron scrap is removed. This unit may be plainly seen to the righ. in Fig. 4. From the screen the sand of graded consistency drops to a 5-ton hopper below. During the screening, a dust-exhauster system consisting of a cyclone separator and a Pangborn dust arrester, removes all the fines as well as smoke and gases trapped in the sand.

Below the 5-ton hopper is a 1-ton measuring hopper from which this quantity of sand is dumped into an 8-ft. Simpson mixing mill. Both these hoppers have pneumatically-controlled gates. In the mill the correct amount of water is added by sprays until the sand is properly tempered. At the same time air is blown into the mill through orifices in an annular pipe so as to cool the sand, which still retains some heat. When tempered, the sand is discharged directly underneath into a 1½-ton hopper from which it is conveyed by another 24-in. belt conveyor to a 40-ton storage tank placed near the sand slinging equipment. An 18-in. apron conveyor underneath this storage tank brings the sand directly to the hopper of the sandslinger. It should also be mentioned that underneath the molding turntable is another belt conveyor that brings the unused sand back to the vibrating screen by discharging its load on the inclined belt leading to the screen.

It is interesting to note that a centralized pressure oiling system is used to assure proper lubrication of the entire unit, including all rollers for the belt conveyors, but not including the rollers on the slow-moving flask conveyor. Hundreds of feet of copper tubing are used to connect up the bearings with the hand-operated supply plungers, located at three strategic points.

Cores for the two main tractor castings are made in a section of the foundry close by the unit just described. Two grades of sand are used, mixed in the proportion of five to seven, and are stored in bins alongside the millroom. Transportation of the sand to the Simpson mixing mill is handled in a novel way. Running into the bins on tracks are two "kickers" or loaders consisting of bucket conveyors with right and left-hand screw flights gathering in the full width of the bins. These loaders discharge into special buckets carried on 1-ton electric hoists on an overhead I-beam monorail, one bucket holding 500 lb. of sand and the other 700 lb. By means of a Bowser metering device a measured quantity of oil is added to this 1,200-lb. batch of sand in the mill, and when thoroughly mixed, the sand is discharged into the boot of a bucket elevator which carries it to bins over the core-making machines.

Two spouts lead to each of the two core-making machines, so that the sand can be dropped directly into the metal core boxes and mechanically jolted. When the core is completed, a cast-iron plate is placed over the core half, and clamped to the core box. The entire unit is then inverted and the core box loosened and removed from the core. About six of these plates with half cores are loaded on a large structural steel frame which in turn is conveyed by a crane to the oven car. This car is in two sections and measures about 20x30 ft. overall. It is mounted on eight flanged wheels and by means of contact prongs is mechanically propelled to and from the oven by means of a motor-driven chain. Two core baking ovens are used, both being fired by city gas compressed in the plant. A cantilever bridge crane running along rails on the side wall is used to handle the cores and loading trays in this section of the foundry.

After the castings are made, the baked core sand is removed from them hydraulically in a large machine of the company's own design. This washing machine, which

Fig. 4—Two of the 24-in. belt conveyors used in the sand recovery system. On its way to discharge sand into a vibrating screen, the belt at the right passes under the magnetic pulley *A*, with its short belt conveyor carrying metal particles to discharge chute *B*. Tempered sand, after it leaves the mixing mill, is conveyed back to storage by the belt shown in the central foreground

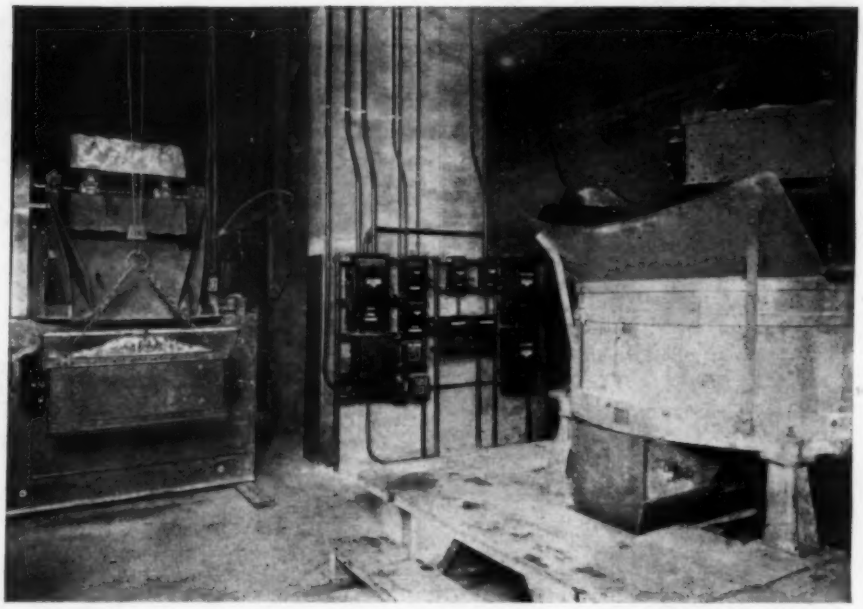
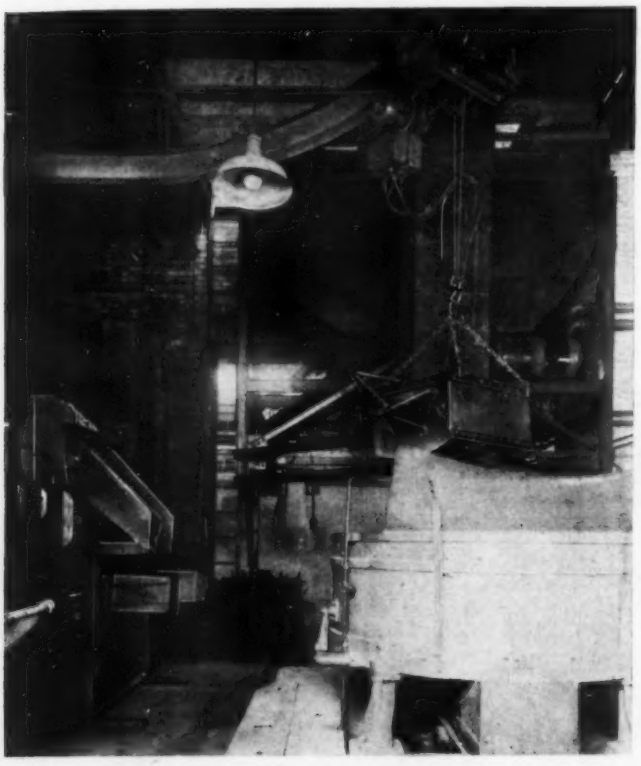


Fig. 5—A view of the mill-room where the core sand is prepared. Two bucket conveyors take the sand out of the bins and place it in the buckets shown, whence it is dumped into the mixing mill. Here, a measured amount of oil is added, and when thoroughly mixed, the sand is elevated into bins

Fig. 6—One of the transfer buckets suspended from an I-beam monorail and about to dump its load through the gates in its bottom. In the background the storage bins and elevator may be seen



can accommodate castings weighing up to 100 tons, consists of a cubical chamber about 45 ft. on a side with two large doors, resembling canal lock gates, that open outward at the front and a roof that can be run back on rails so as to allow a bridge crane to bring heavy pieces into the chamber. Several jets of water under a pressure of 450 lb. per sq.in. are directed against the castings by means of nozzles mounted on universal joints and controlled by operators who view the work from behind glass windows. The operation is very similar to hydraulic, open-pit mining. Large castings, such as turbine bases weighing 100 tons, can be freed of cores in a few hours, where previously a week would be required.

When tractor castings are cleaned, they are placed in carrier plates, mentioned previously, and are loaded on a turntable about 10 ft. in diameter which is rotated under the pressure of the water jets. The core sand and also the slight amount of foundry sand adhering to the castings is washed into compartments surrounding the washing machine from which the sand is removed by grab bucket and dumped on the foundry floor. By allowing it to drain over a grate of tiling, the sand is recovered for later use in core making.

After the castings leave the washer, they are brought to the cleaning room where they are sandblasted, then chipped and snagged. Owing to the type of castings, no risers are necessary, thus simplifying the chipping operation. The pouring gates are removed by a blow from a sledge hammer when the castings are first removed from the flasks. After cleaning, the castings are loaded on flat cars and transmitted to an unloading track alongside the tractor building. At this point they are removed by means of a 1-ton electric hoist suspended from an overhead monorail, and are brought directly alongside of the milling machines for the first operation.

In another foundry building small parts for the model U tractor are cast on modern equipment, including molding machines of recent design.

Changes in Locomotive Shop Practice

By M. H. Westbrook

Shop Supt., Battle Creek Shops, Grand Trunk Railway System

RECENTLY, I was handed six samples of cold chisels, well made, heat-treated, and said to be the last word in chisel perfection. I was asked to have them thoroughly tested.

Upon going through the shop, a modern twenty-pit one, it was found impossible to locate a department where, in the course of regular shop procedure, these chisels could be given a practical test. Either the parts that formerly required chipping had been machined sufficiently close to requirements, or they were being ground. The only chipping practice being followed was by means of pneumatic tools in the hands of the boilermakers. The only machinist found chipping was fitting a smokestack base to a locomotive smokebox, and he was also using a pneumatic tool.

Fig. 1—Monorail crane system employed in transporting finished gears approximately 150 yd. from the tractor shop to the heat-treating shop shown in the background. There is a 20-ft. difference in elevation between the loading points at each end of the line

Case-Hardening Practice for Tractor Gears

By J. Fletcher Harper

Research Engineer,
Allis-Chalmers Manufacturing Company

Allis-Chalmers tractor gears and spline shafts are carburized, hardened, and drawn in electrically-heated units, semi-automatic in operation and with a smooth flow of work between units

IN THE leading article of this issue it was shown how the Allis-Chalmers Manufacturing Company had organized and built an entirely new shop for the production of Model U tractor units, and how prominent a part gear cutting played in the scheme of things. It is with the work of heat-treating these gears that the present article is concerned. After leaving the gear cutting machines, all gears are inspected, washed, and placed on loading spindles so that a batch of them can be rolled over to the door for transfer to the heat-treating department. For transportation of splined shafts and gears and pinions cut integral with the shafts, special racks have been constructed of sheet-steel plates welded together.

The heat-treating department is in a separate building, 150 yards from the end of the gear department, and is situated down in a hollow. Transportation between buildings is by means of an overhead monorail system from which an electric crane, including the operator's cab, is suspended, as shown in Fig. 1. As can be seen from this view, showing the heat-treating shop in the background, a single I-beam suspended from structural "bents" is used for the monorail. The reason for this system is the fact that at the loading end, the cab bottom just clears the floor of the platform, but is over 20 ft. from the ground at the other end. Otherwise a simple power monorail system might have been employed. In the illustration, two stacks of bevel gears can be seen en route to the door of the heat-treating shop, which is at the far end of the line.

This shop is located adjacent to a part of the works where a larger size tractor has been produced for some time, and is in reality the old heat-treating plant enlarged to twice the original size. In the addition, all new equipment has been installed for handling all gear and shaft work for the new Model U tractor as well as the gears for the "Monarch" tractor made in the Springfield (Ill.) Works. Electric heat is used throughout, largely because power is generated in the works at lower cost than fuel oil or gas could be purchased. Cleanliness was also a factor in the choice of the heating medium as well as the limitation of using certain types of furnaces that are adaptable only for electric heat.

The shop is well lighted and is naturally free from fumes and smoke. Large steel frame windows, brick and corrugated sheet steel form the side walls, while steel trusses carry the "Pond" roof, which is made of hollow tile. Concrete is used for the floor. All apparatus is protected with aluminum paint.

Gears and shafts entering this department vary from

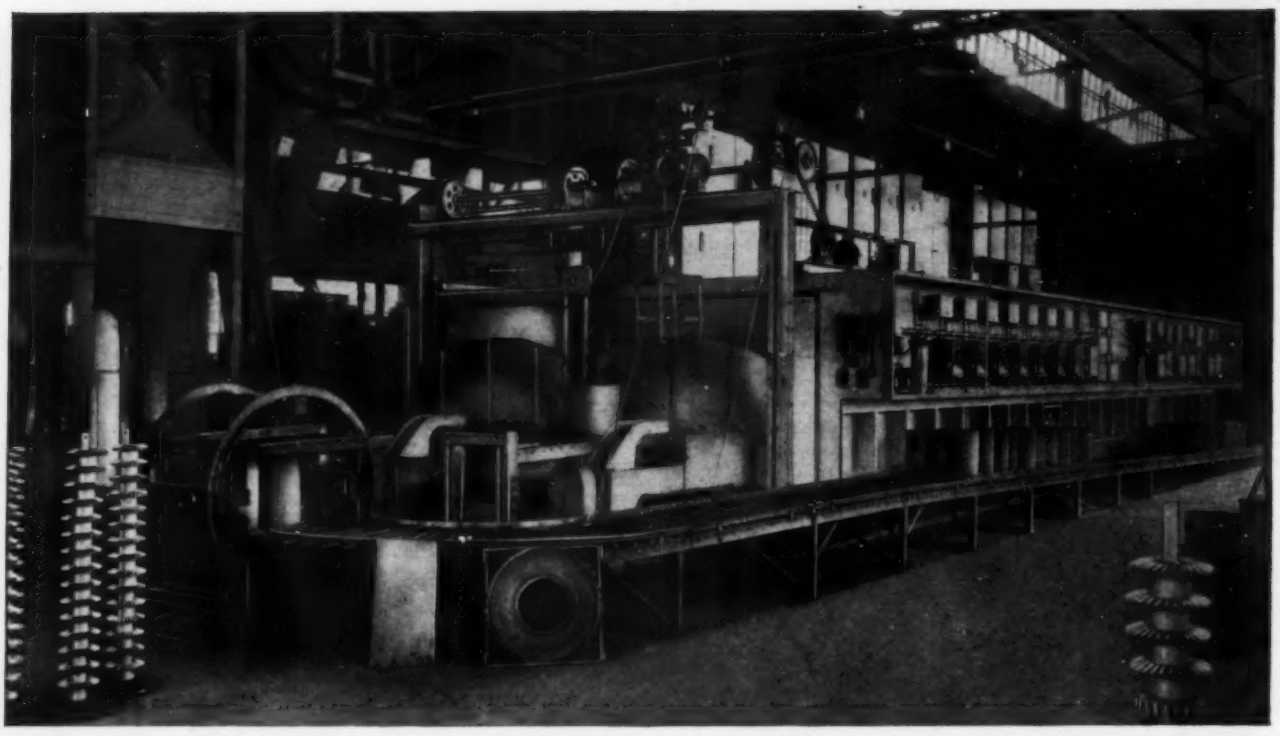
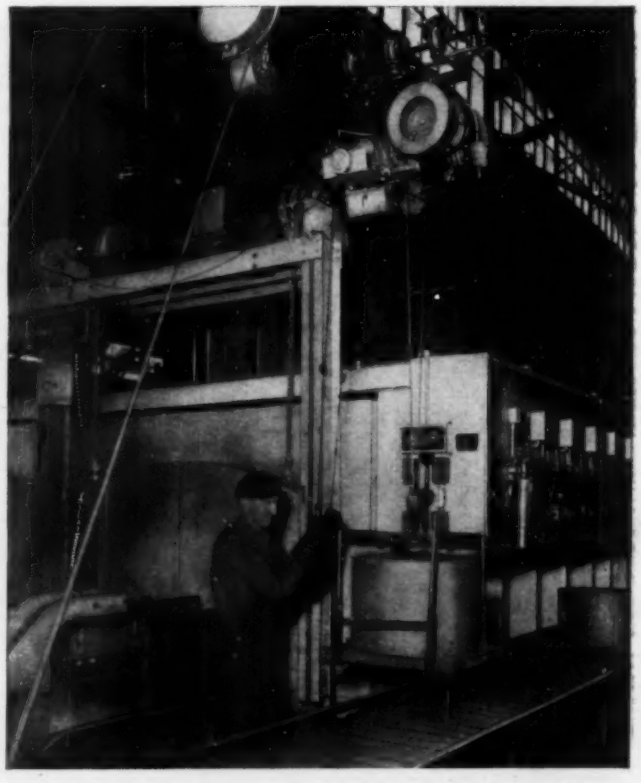


Fig. 2—Fully-automatic "Hevi-Duty" electric carburizing furnace with its recording pyrometer controls along the side wall and gravity conveyor system, which surrounds it. At the left may be seen a set of pots being rolled over after the compound has been packed in place

low-carbon to 5 per cent nickel steel, so that the problem of treatment is somewhat complicated. All parts however are carburized in the automatic Hevi-Duty furnace, shown in Fig. 2. In this view the pots are seen loaded in trays going down a gravity roller conveyor, which completely surrounds the furnace. These trays, measuring 14x28 in., carry three 8-in. pots, or two 10- or 12-in. pots. For large size ring gears, 24-in. pots are used, loaded on 28x28-in. trays. Carburizing compound is stored in overhead bins, at the left, and poured into the pots through flexible hose while each gear is packed in position. When the pots are loaded, they are pushed a few feet along a roller conveyor to a rollover device. Here each set of pots is clamped firmly to a tray placed on top, and the whole rolled over. Thus the pots are left standing in an inverted position on the tray. In this way they travel through the furnace, no attempt being made to seal them with fire clay or the like, as is usual practice. This procedure is possible since there is no tendency for air to flow into the pots while in this position. In fact, as the pots are heated, the air trapped in them expands and is partially expelled at the bottom.

The electrically heated carburizing furnace, the control of which is almost entirely automatic, is about 48 ft. long. There are four compartments running lengthwise with two mechanically-operated doors at each end exposing two compartments. The compartments are paired off, making two distinct furnaces which will be described as a unit from this point on. Pots in alternate rows travel in different directions under the impulse of a ram at each end. Once every hour, both doors open automatically, and a waiting tray carrying its pots is pushed into the furnace by the ram. Simultaneously a tray emerges at the other end, since the trays contact with each other successively. Disk rollers reduce the frictional load. The ram travel is 28 in., so that when 14-in. trays are used, a blank tray must be inserted between two loaded ones in order to charge one set of pots per hour. With 28-in. trays, this procedure is not necessary.

Fig. 3—A special rigging has been adopted for handling pots on and off the furnace ways with the aid of a 1-ton electric hoist suspended from a monorail



The first 12 ft. of the furnace, measured from either door, is either a pre-heating or a cooling zone, depending upon whether the work is entering or leaving the furnace. Advantage is taken of the adjacent chambers to obtain an interchange of heat between the hot and the cold work through radiation. To accomplish this the dividing wall between compartments is omitted at this section. On the entering end, the next 6 ft. of space is a rapid heating zone where the pots are brought up to the carburizing heat. In this section, there are heating elements on four sides, that is, on both side walls, in the floor, and in the roof. In the adjacent soaking section, which is 16 ft. long, on the other hand, heating elements are provided only in the floor. Beyond this point no heat is applied as this is the cooling zone.

Pots are handled on and off the furnace ways by means of a ½-ton electric hoist suspended from a monorail, one at each end of the furnace, as shown in Fig. 3. For this purpose a special rigging has been adopted which grasps the bottom of the tray somewhat like a pair of tongs. Discharged pots are either placed directly on a dumping gate, or if they come off the far end, are pushed down the gravity conveyor along the side wall to the same point. Underneath the grate is a hopper leading directly to the boot of a bucket conveyor which elevates the compound to a screen, whence it drops into the storage bins for later re-use.

Owing to the fact that it takes several days to bring the furnace up to heat from the cold condition, it is operated 24 hours a day, seven days a week. Eight Leeds & Northrup recording control pyrometers maintain the furnace temperature. Four of the thermocouple elements are placed in the heating zone of each compartment and four in the holding heat zones, toward the cooling end. This allows separate temperatures to be maintained in each row. Four Stromberg electric

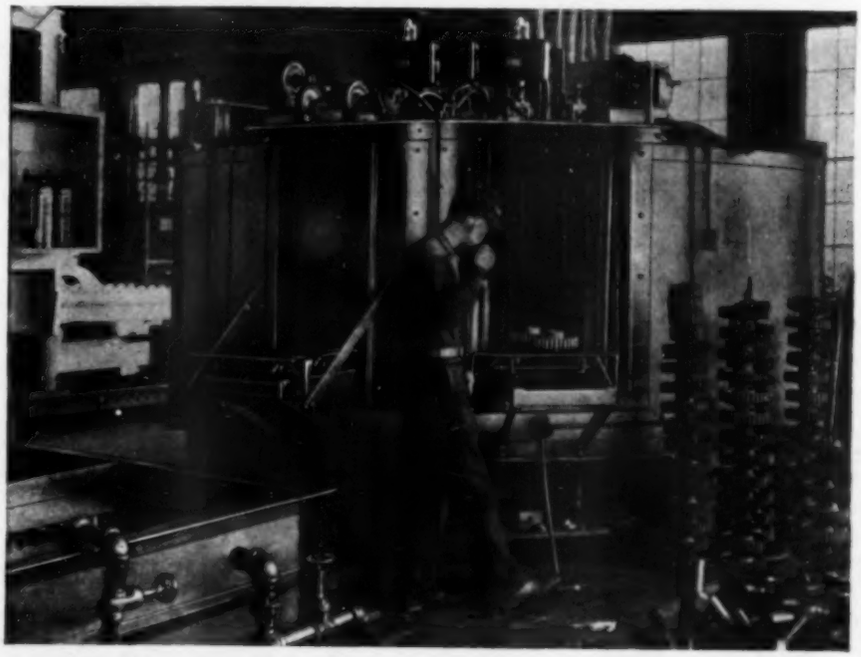
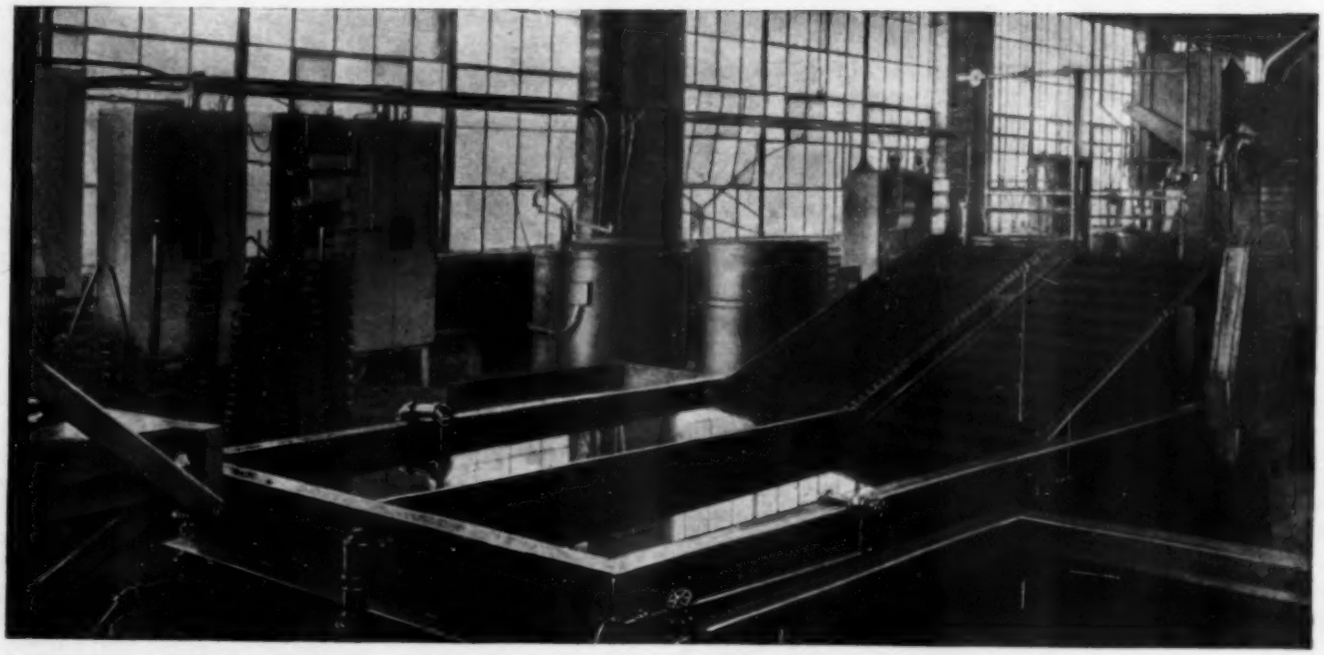


Fig. 4—One of the two "Hevi-Duty" rotary-hearth electric furnaces in which the carburized parts are heated twice, once for an oil quench and later for a water quench. A combination quenching tank can be seen to the left

Fig. 5 — The pot-type Leeds & Northup electric furnaces at the left are used for drawing small gears. "Hump" furnaces in the background are used for hardening large ring gears in a quenching press located between them. The quench tanks in the foreground are for use in connection with two rotary-hearth furnaces



clocks time the automatic opening and closing of the furnace doors at each end and actuate the pusher mechanism. The rated capacity of the furnace is 50,000 lb. gross load, including weight of pots and compound, per 24 hours. If necessity arises, the same furnace can be employed for normalizing. When so used in an actual test, 57,000 lb. net of forgings were treated in 24 hours. The normal cycle for carburizing to the depth of case required is 26 hours, with a 10-hour cooling period after the pots leave the furnace.

After being carburized, all small alloy gears and shafts weighing up to 40 lb. are placed in a 150-kw. rotary-hearth Hevi-Duty electric furnace, of which there are two, and are heated to the proper temperature for core refinement, quenched in oil, reheated in the second to the proper temperature for case refinement, and quenched in water. These furnaces handle between 1,200 and 1,400 lb. of gears per hour. The cycle of the hearth is about 1 hour, 20 min., but this can be lessened when small gears are being treated. The maximum temperature available is 1,850 deg. F. Fig. 4 shows a view of one of the rotary furnaces with the combination oil and water quench tank shown in the left foreground. Parts submerged in the quenching medium are brought out by continuously moving chain belt conveyors.

Each rotary unit is divided into three heating zones with a thermocouple lead in each. The thermocouples in the zone near the loading door and in the central one are connected to Leeds & Northrup indicating control pyrometers, while that in the third zone is connected to a recording control type pyrometer.

Two doors are provided on the furnace, one for loading, the other for unloading. Both doors are elevated and closed by means of separate motor-driven units actuated by foot-controlled push buttons in the floor, as shown in Fig. 4. The arrangement is such that the operator can haul the work out of the furnace and plunge it directly into the quench tank without taking more than one or two steps.

After the final water quench the gears and shafts are loaded in baskets and are drawn in Leeds & Northrup "Homo" pot-type furnaces at a temperature from 250-450 deg. F. for 2 hours.

In this type of equipment, the work receives its heat by contact with air alternately driven in one direction and then reversed every minute by a fan in the base. The air that gives up its heat to the work is heated by electrical coils placed in an annular chamber surrounding the pot. Dimensions of the pot are 20 in. diameter and 26 in. deep. These furnaces, of which there are two also, are rated at 24 kw., and they are both controlled separately by recording control pyrometers.

Large ring gears, after being caburized, receive somewhat different treatment than the smaller gears, in that they are merely heated once and are quenched in water. Heating takes place in one of two Leeds & Northrup "Hump" furnaces, also electrically heated and rated at 18 kw., with recording pyrometer control.

The pot measures 24 in. in diam. by 18 in. deep and from one to three gears can be stacked in it on a mandrel. The time-temperature curve of the instrument is watched for the characteristic hump at the critical point, from which the method takes its name. At a predetermined time beyond this, the work is withdrawn. Quenching is performed in a press located immediately adjacent. This press is operated hydraulically, and the same means of control is used for elevating the furnace lid when loading or unloading gears. Drawing follows as for the smaller gears.

After heat-treatment, all gears and shafts are sent through a Pangborn sandblast machine to remove the scale and to give the work a clean appearance. This end of the heat-treating shop can be seen in Fig. 5, which also shows the Homo and Hump electric furnaces with their controls. A 1-ton electric hoist on a monorail serves this section. Before it is sent back to the main shop, every gear is checked for hardness with a Shore scleroscope.

The arrangement of the shop allows a continuous movement of material throughout the various operations without back tracking or extra handling. From the time the gears enter the shop until the final inspection they have a straight line flow.

Ammonia-Treated Gage Steel

By A. J. Wormwood
Supervisor of Gages
Independent Pneumatic Tool Company

SOME of the high spots in our experiments with gage steels show several interesting facts. Early in our tests, we found a great difference in the wearing qualities of duplicate gages in the hands of different operators, so we selected one operator to carry on the comparative tests. A plug gage used in checking a lapping operation in a hole 1.9625 in. in diameter and 1¼ in. deep, was the subject of our experiments.

Gages made from machinery steel, carburized with material previously used in production work, showed appreciable wear after gaging an average of 90 holes per gage. Gages made from the same steel, but carburized with new material gaged an average of 320 holes per gage. Purchased gages, made from a steel that conformed to the SAE 5195 specifications, showed appreciable wear after gaging an average of 340 holes per gage; not enough of a gain to pay for the increased cost of the gages. Gages made from an oil-hardening steel, quenched at 1,500 deg. F. and drawn to 300 deg. F., showed appreciable wear after gaging an average of 640 holes per gage.

Gages made from an ammonia-treated steel, known as Nitralloy, have given us the best results, showing appreciable wear only after gaging an average of 1,044 holes per gage. Other specimens of this steel, in the course of preparation, are to be subjected to ammonia gas for longer periods of time with the expectation of far better results.

In gaging the ground holes in hardened gears and bushings, 800 pieces per 0.0001 in. of gage wear has been our previous high record. With gages made from ammonia-treated steel, our average, so far, has been 1,204 pieces per 0.0001 in. of gage wear. Even this average seems to be low, yet it is the best we have had from our most careful operator.

No one seems to have any data that can be used as a standard. Most gage makers may not realize the value of checking up the lives of gages made from different steels, and gage makers may not feel safe in giving figures, because of the great difference in results obtained by careful operators and those who are careless. However, we have found that it pays to watch the lives of our gages, and are continuing our experiments with the hope that we can produce gages that will last almost indefinitely.

Heavy Castings and Special Machines

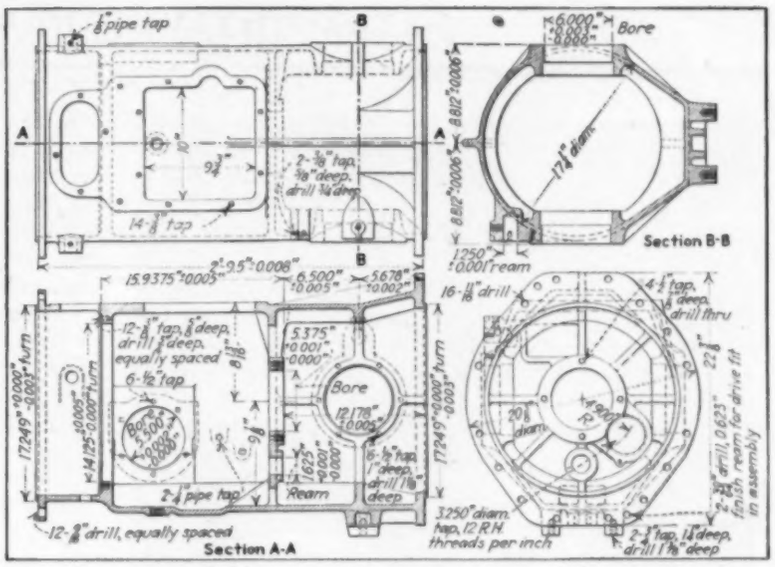


Fig. 1—Transmission case of the Allis-Chalmers Model U tractor

By H. W. LIEBERT

General Superintendent, Tractor Division
Allis-Chalmers Manufacturing Company

How two tractor castings weighing 350 and 450 lb. are completely machined

AS WAS seen in the article appearing on page 436 of this issue, the production of a tractor can be resolved into a relatively few number of operations compared to automotive practice. In the first place, the motor for the Model U tractor made by the Allis-Chalmers Manufacturing Co., is a purchased unit, and this at once eliminates all the equipment ordinarily needed for motor manufacture. There are then left only two main castings to be considered, the transmission case and the rear axle housing to which it is bolted. These, together with the engine make up the chassis of the vehicle. Equipment for machining these two large castings, which weigh 350 and 450 lb., is segregated in a part of the shop where plenty of room for storage of unfinished and finished castings is available. Castings come in from the foundry on flat cars and are unloaded by a ½-ton electric crane operated on an overhead monorail.

In Fig. 1, the details of the transmission case are shown. The forward part serves as the clutch housing with shifter arm bosses on the case, the central section is for the transmission gear box, while the rear section carries the cross-shaft for the spur gear reduction to the rear axle. To the front end of the gear box proper is bolted a cover plate bored to correspond to the cast-in plate at the rear. On the main bores limits of +0.001, —0.000 in. are specified.

The first operation on the piece is to mill both ends and the cover plate while the casting is supported in a box fixture mounted on the bed of a planer-type miller. It is a three-head, six-spindle machine, and is provided with three sets of inserted-tooth cutters. Floor to floor time is 12 min. In this set-up the axis of the work is at right angles to the direction of table travel. On account of the heavy cuts taken, it is necessary to support the casting at as many places as possible. In the lower part of the fixture are several spring-actuated plungers that automatically locate themselves against the sides of the casting and are then locked in position by hand. Similarly a number of swing studs with adjustable noses bear against the sloping sides of the casting near the top.

Milling of the two pads on one side and one pad on the other follows in the second set-up in which a much lighter machine is involved. This is a 30-in. by 4-ft. modified duplex planer miller, shown in Fig. 2. Oilgear feed is used in this unit, whereas a mechanical screw feed is used for the first miller. In order to assure that the upper cutter on the right will not deflect outward under load, an extra overarm support has been added to tie the columns of the machine together at the top. As can be seen, the casting is turned on end and is clamped by the lower flange. It rests against a pedestal support at the rear to which is attached an arm, not shown, carrying a setscrew to take up the reaction of the upper cutter. The work is held to the pedestal though a crossbar and clamp screw slipped through the coverplate opening. Steel blocks on the base of the table position the piece approximately, but final alignment is by feel against a steel bar on the side of the pedestal.

Two boring operations follow. In the first, all the holes concentric with the main longitudinal axis are bored and the two end flanges are faced and recessed to form a shoulder on the inside edge; in the second, the cross holes are bored and two holes parallel to, but offset from, the main axis are finished. In the first of these set-ups a rather special machine, Fig. 3, is involved. It

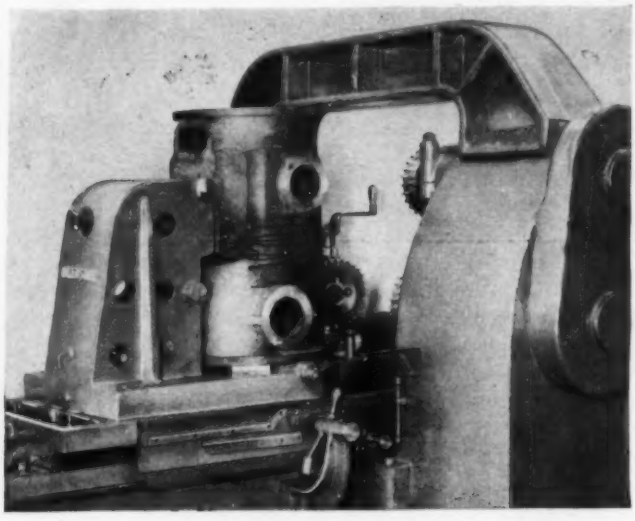


Fig. 2—In order to spot mill the bosses on the sides, the case is turned on end and clamped against a special pedestal. The work is fed into the cutters hydraulically

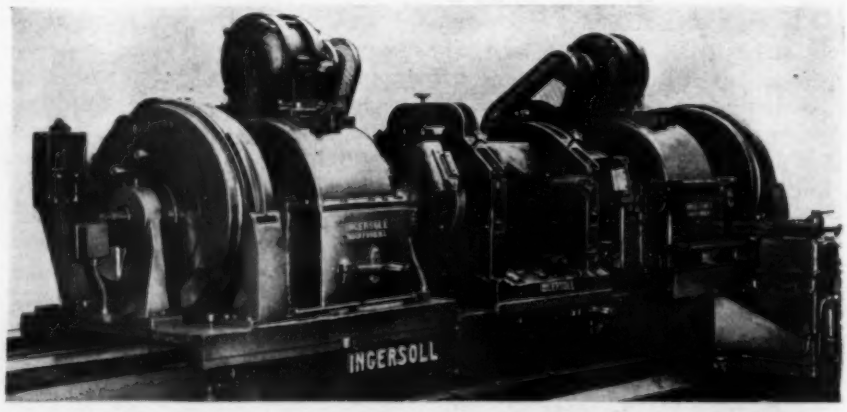
is a duplex boring machine with both heads advanced hydraulically, and each carries special boring and facing cutters. Fig. 4 shows the fixture for supporting the casting and some of the tooling. The pedestal supporting the guide bushing for the left-hand bar protrudes into the hollow casting through the cover plate opening, which is face down. This bar carries a set of cutters for boring the central hole 5⅛ in. in diameter, as well as facing tools for the boss surrounding this hole. Tools on the right-hand head bore and face the front hole, 14.125 in. in diam., to which the head plate is bolted. Facing of the ends to form the shoulders is by opposing tools carried on a crossarm shown best in Fig. 5. These tools are advanced toward the center by right- and left-hand screws actuated, in the final analysis, by planetary gearing controlled by a magnetic brake. Ordinarily the planetary drum revolves on a sleeve concentric with the boring bar until clamped by the brake, at which time the side tools are advanced. Floor-to-floor time for these operations is 26 minutes.

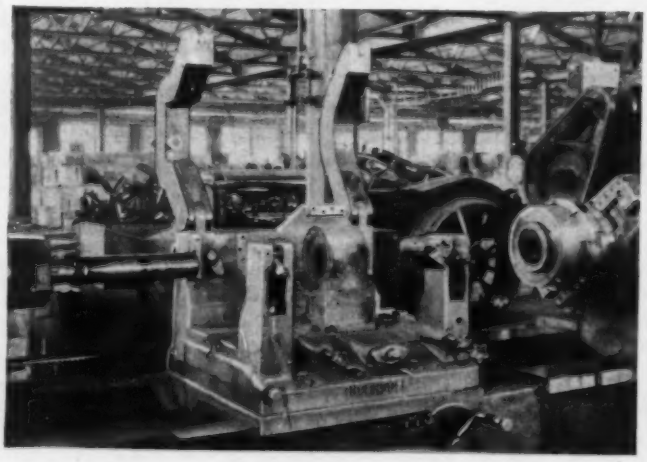
Boring of the three side holes, two diammetrically opposed for the cross-shaft, the other for the power takeoff member, takes place in a three-way boring machine. In the same set-up, two holes in the rear headwall are bored and reamed and one of them is tapped by a special head which was added to the original machine. This tapping head has screw feed, but the other three heads are advanced hydraulically. The casting rests in the fixture upside down and is held by a clamp bar at the rear end and a swing clamp stud at the other. In addition a plate clamps it through the cover opening and a T-clamp grips each flange at the bottom. Stabilization endwise is by setscrews bearing against the flange at two points. Floor-to-floor time on this operation is about 12 min. so that the operator of this unit also assists on the four drilling and tapping units used to complete the piece. In this connection, it should be mentioned that one man handles

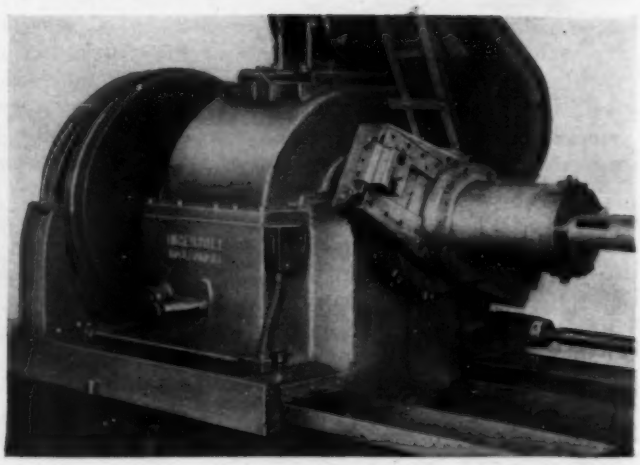
Fig. 3—Front and rear flanges are bored and faced and other longitudinal diameters finished in this special machine. Both tool heads are advanced hydraulically while the casting is supported in a cradle fixture

Fig. 4—Details of the boring fixture, showing the two swing clamps and the ball-bearing support bushing for the boring bar. The pedestal upon which the guide bushing is mounted extends up through the opening in the top of the casting

Fig. 5—Close-up view of the left boring head. Additional tools, not shown, are inserted in the slot for boring a hole 5⅛ in. in diam. Just back of this position are facing tools actuated by a planetary train







the first two milling operations and another the large boring operation.

Two drilling and two tapping operations follow. In the first set-up, 42 holes are drilled in the top, bottom, and front end. The casting is laid on its side in the fixture shown in Fig. 6, which is mounted on the bed of a three-way, fixed-center, multiple-spindle drilling machine arranged with hydraulic feed. Points of location of the cases are the cross bores. Plungers entering them are located in the top and bottom of the fixture, the bottom one being actuated by a cam and the lever shown at the front of the machine. The top plunger is carried on a counterbalanced, hinged bracket. When this bracket is clamped in position by a swing bolt, final location of the upper plunger is through rack and pinion movement controlled by a hand lever.

The ends of the transmission case are located on the finished ODs of the turned flanges through hardened steel pads. To facilitate loading, the front of the fixture is hinged, and in the photograph is shown in the open position. In order that all of the drill bushings be carried as close to the work as possible, the bushing plate on the right-hand head is mounted like the stripper plate of a press punch; that is, it slides on four horizontal posts and is held against the case through spring pressure.

A similar fixture is used to hold the case for the tapping operation that follows in which 24 of the holes are tapped. The casting is then placed in a second drilling unit, this time rest-

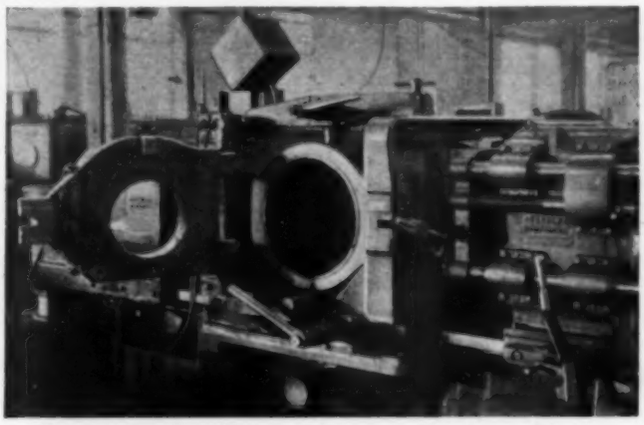


Fig. 6—Multiple drilling and tapping operations are performed on the case while it is held in box-like fixtures, such as the one shown

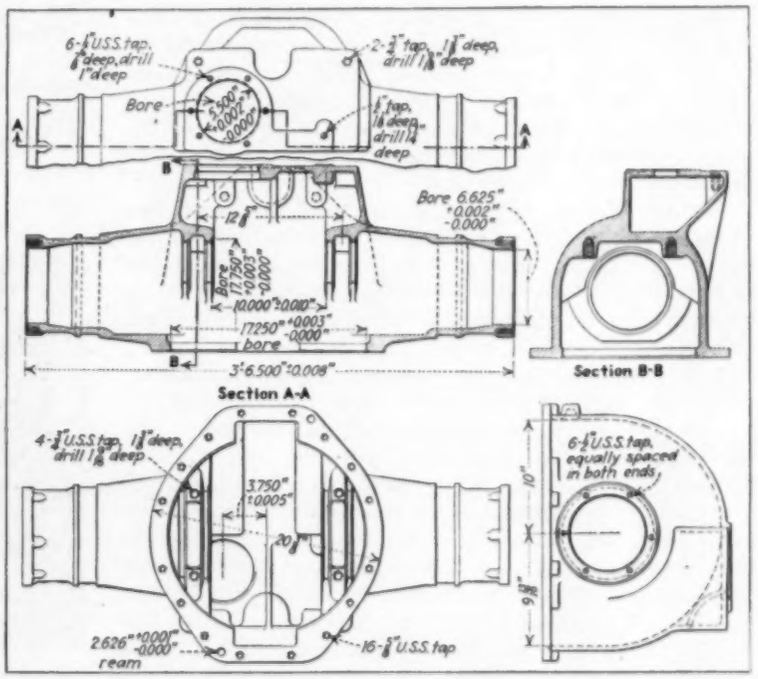
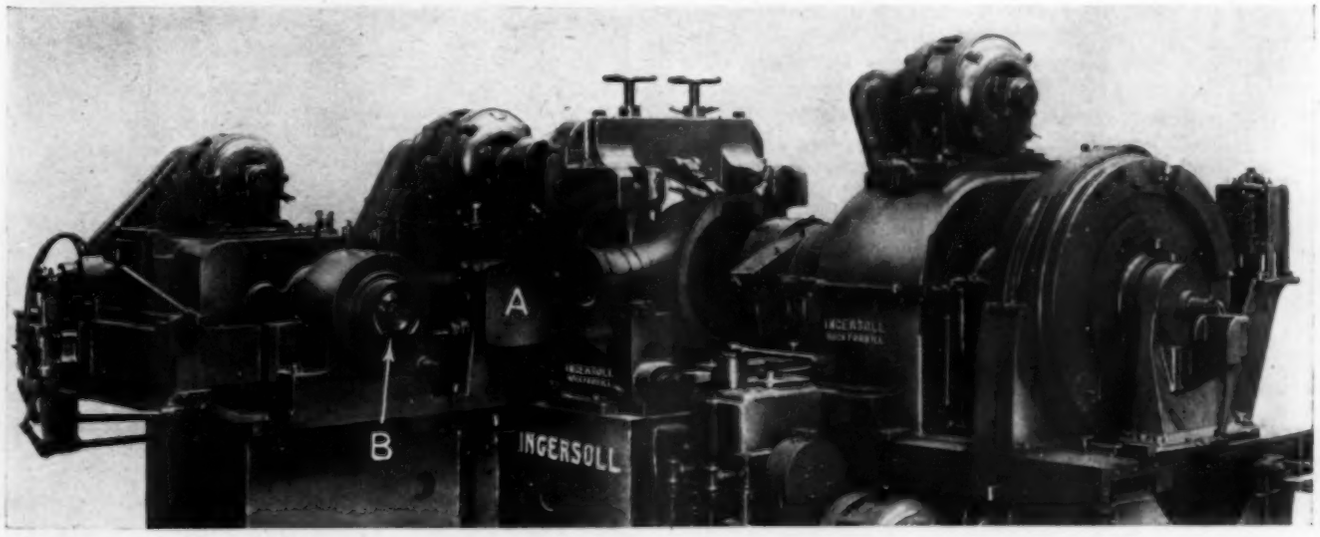


Fig. 7—Details of the rear axle housing for the Allis-Chalmers Model U tractor

Fig. 8—Cross movement of the head at the left brings a face milling cutter, hidden behind shield A, into action, followed by longitudinal movement of boring bar B. Previously the front end is bored and faced with the special head at the right



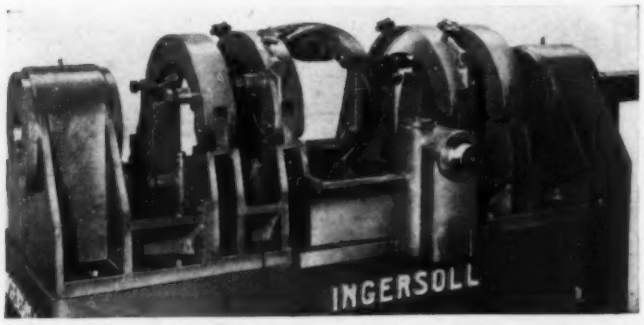


Fig. 9—By means of two sets of swing clamps, housings for two different-sized tractors can be machined in this fixture

ing on its bottom and reversed, end for end. In this position, 41 other holes are drilled; for the pulley bracket, the cross-shaft bearing caps, and in the front end. Of these holes, 24 are tapped and 3 reamed in the last machine of the series. The tapping units are similar to the drilling units, except that lead-screw feed is applied in place of hydraulic feed. Fixture construction is also basically the same, except that when the case is in the second position, location is by a rectangular plunger that fits the opening in the top.

The floor-to-floor time for all drilling and tapping operations is 12 min. One casting is run through at a time, and one operator tends all four machines and carries the castings between them by means of a chain block suspended from an overhead monorail. Because the first boring operation takes 26 min., and is therefore the key position, this same drill operator tends the other line of drilling and tapping units for the rear axle housing and is assisted by the second boring machine operator. The full time of less than four men, therefore, is all that is required for the entire work on the transmission case.

Equipment for machining the rear axle housing, shown in Fig. 7, is located alongside the line for finishing the transmission case so that certain operators can work on both lines simultaneously, as has been indicated. In this way, six men can produce 50 of each or a total of 100 finished castings in a 24-hour day on a group of fourteen machines.

In the first set-up of the rear axle housing, the front flange is bored to a diameter of 17.250 in. and is then faced, after which the pad at the rear is faced and then bored to a diameter of 5.500 in. These operations are performed in a machine of very special design, Fig. 8. The right-hand head is practically identical in construction with that used for boring the large diameters of the transmission case and shown in Figs. 3 and 5, movement of the facing tools being controlled by a planetary gear mechanism. The left-hand heads are quite special in construction. Facing is done by an inserted-tooth milling cutter whose spindle is mounted cross-ways to the bed of a hydraulically fed table. On this same table, at one end, is a secondary hydraulically-fed slide carrying a boring bar, traveling at right angles to the first.

In operation, the right-hand head of the machine is advanced, carrying rough and finish boring tools into the work until the head comes up against a positive stop. At this point, the planetary drum is stopped by a magnetic brake and rough and finishing facing tools brought into operation. Upon completion of the cut the spindle stops automatically, and the head is withdrawn. The milling cutter on the left-hand head is now rapid advanced, fed through the work and rapid advanced beyond until the boring bar is brought into position at which point the feed stops. The boring bar is then fed into the work, withdrawn and stopped.

An even greater number of operations are performed in the second set-up in which the housing is bored and faced longitudinally. The casting is stabilized by steel plates engaging the bore at the front end and is clamped by swing arms on either side against spring-adjusted studs on the bottom. Essentially, the machine consists of a bed upon which the fixture is mounted and a long extension upon which the hydraulically fed head slides. A long slotted boring bar is carried on this head, whose movement is such that the bar can be withdrawn completely from the work. When the casting is in position, the bar, carrying no tools, is run through the work.

The first job is to mount a set of tools for boring and then countersinking the cradles for supporting the differential bearing carriers. For this work, the tool holder is split in half and is bolted through one of the slots in the bar. These tools are afterwards withdrawn and the tools inserted for rough and finish boring the bearing holes at the ends. High-speed steel tools are

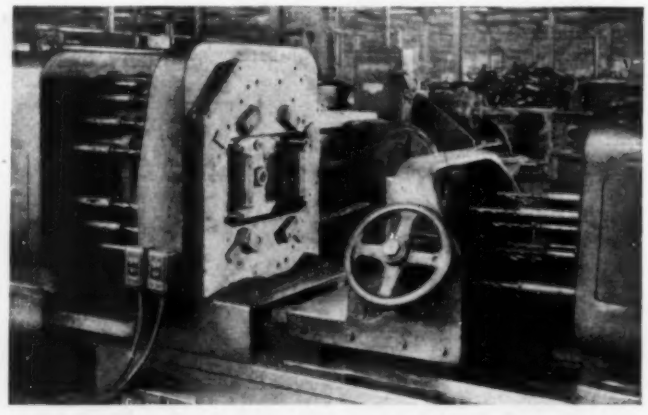


Fig. 10—The housing is held with its front face located against blocks on the pedestal. Stabilization against rotation is by a plug carried on an outboard arm

mounted in steel plates which are clamped in slots at two positions on the bar. First one end is bored, then the other, Facing of these ends is the final job. Flat forming tools are used, mounted in hinged tool holders which are placed around the bar and clamped in place. The bar is fed first toward one face and then toward the other. Total floor-to-floor time is 18 minutes. Cycle control is by hand throttle in conjunction with a set of combination stops carried on a three-position indexing drum, controlled by a pointer and dial.

These two set-ups complete the boring and facing operations on the rear axle housing. It only remains to drill and tap numerous small holes. Four Greenlee multiple-spindle, fixed-center machines are employed in the line-up. Fig. 10 shows the fixture for the first operation in which 31 holes are drilled in the transmission contact end and in the rear end, while Fig. 11

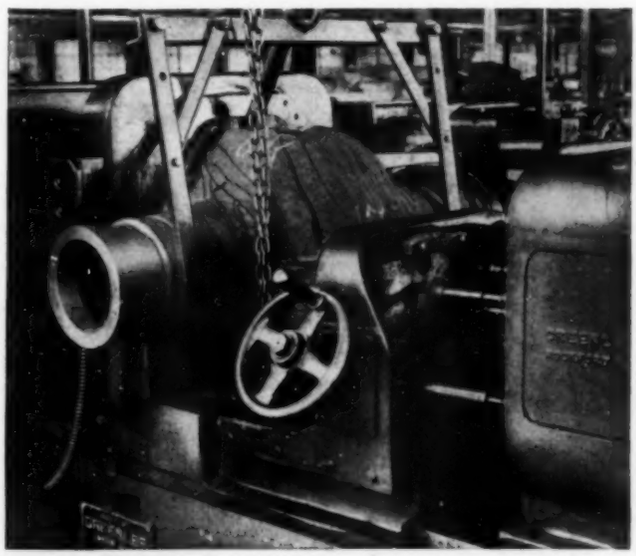
shows the casting held in an identical fixture (except that guide bushings are not provided) for the following operation in which 26 holes are tapped and 2 reamed. Hydraulic feed is used in the first instance and lead screw in the second.

The action of this fixture is similar to a vise. The bushing plate for the transmission contact face is stationary, while the plate for the rear face is attached to a slide which is actuated by a screw and handwheel shown in the central foreground. Location of the work is by the large bore at the front end and the small bore, eccentric to the first, at the rear. For squaring the work in a horizontal plane, a third locating plunger, shown at the rear, engages one of the wheel bores. This same fixture can be employed also for a shorter rear axle for a narrow tread model, since the last mentioned plunger is mounted on an adjustable bracket. The number, size and spacing of the holes is the same in each casting, so that the changeover is simplified.

For drilling the holes in the end flanges for the bearing retainers and in the top for the cover, the casting is placed in a three-way horizontal machine in the fixture shown in Fig. 12. A similar set-up is used for the tapping operation. This fixture is adjustable for length also. The bushing plate for the top remains in a stationary position, but those for the two ends are movable along ways by right- and left-hand screws actuated through a handwheel at the front. Plungers carried in the end bushing plates locate in the end bearing holes, and the transmission contact face is squared up by an eccentric roll controlled by a crank and plunger *A*. For initial alignment, the casting rests upon two hardened steel slides *B* on either side of the roll.

One type of housing, for the Model U tractor, requires six holes in each end and two holes in the top face; the short housing requires eight holes in each end and two holes in the rear face, all separately spaced. Each of the three heads, therefore, carries bushing plates

Fig. 11—A similar fixture to the one shown in Fig. 10 is used for multiple tapping. In this view may also be seen the sling for transporting the casting between operations by overhead monorail



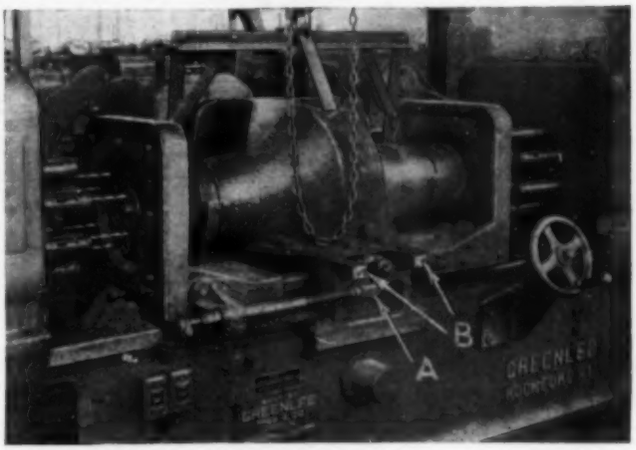


Fig. 12—Provision is made for drilling and later tapping two sizes of rear axle housings in this fixture. The heads carrying the bushing plates are advanced simultaneously by the handwheel shown. Location is by disk plugs in the end bore; clamping, by a bar against the bottom face

with the necessary number of spindles and bushings, spaced properly for both types of housings. Drills are shifted from one set of spindles to the other, depending upon which housing is being drilled.

Practical Contact for the Designer
Discussion

By W. R. Needham
Engineer, Design Department, English Electric Company, Ltd.

ARISING from the contribution by W. F. Kunz, on page 246, Vol. 71, of the *American Machinist*, the idea that practical contacts are essentials of sound draftsmanship, whether or not they are officially regarded as such, cannot be overstressed. The man who can appreciate the point of view of the shop man, who can design to the best practical advantage, and can choose that one which shall best answer the case where alternative machines and processes are possible, is treble the value to the company that the mere copyist, bound slavishly to precedent, can ever hope to be.

If a man finds himself deficient in practical knowledge in any particular which affects his usefulness, the defect can be remedied with application and observation. Let him take careful note, as he passes through the various shops, of the machine tools and processes. Keenness of perception is not wholly a matter of temperament. It can be cultivated to an astonishing extent. With practice, what the eye learns to see, the brain learns to store, and the mind learns to interpret. When a shop alteration, to aid practicability and utilize machining and other provisions to better advantage, is made to a designer's drawing, he should seek to know the "why" as well as the "how" of the matter. A little trouble taken then to understand the reason for the change can go far to acquaint him with information of the utmost value to him, and through him, to his employers.

It is sound sense when draftsmen are deliberately encouraged to get into effective touch with the shops. It is good for company and men alike.

Special-Purpose Equipment for Accurate Tractor Parts

By Frank J. Oliver, Jr.
Western Editor, American Machinist

Machines built up from standard units, but with special fixtures and tooling, allow a number of operations to be performed in a single set-up with close working tolerances

TRACTOR production differs from automotive production largely in the fact that the parts are fewer and heavier and have a smaller number of finished surfaces. Because tractors are subject to conditions of wear that are practically never encountered in general automotive practice, the limits adhered to on the key dimensions are within a narrow range. These key dimensions are relatively few, however, and the other dimensions need not be very close. This premise suggests that the various machining operations can be simplified considerably over what would be considered necessary for the equivalent passenger car or truck part, without, of course, sacrificing the required accuracy.

One way to attain simplicity and at the same time maintain accuracy is to perform as many operations as possible in a single set-up. It is this scheme that is the fundamental basis of design of the five special machines made by the W. F. & John Barnes Company, Rockford, Ill., for machining certain parts of the Model U tractor made by the Allis-Chalmers Manufacturing Company.

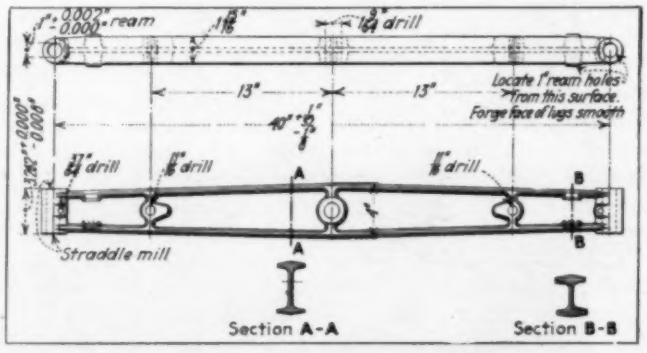


Fig. 3—Details of the front axle, which is made of SAE 1045 steel. Only two set-ups are necessary to finish the piece; in the first the ends at the kingpin bosses are straddle-milled, and in the second, all the holes are drilled and two of them reamed

These machines are constructed from standard units, but are equipped with some novel fixtures and tooling, and as such they exemplify in a striking manner the modern trend in machine tool design.

Fig. 1—Transmission case head of the Allis-Chalmers Model U tractor. The piece is completely machined in four set-ups

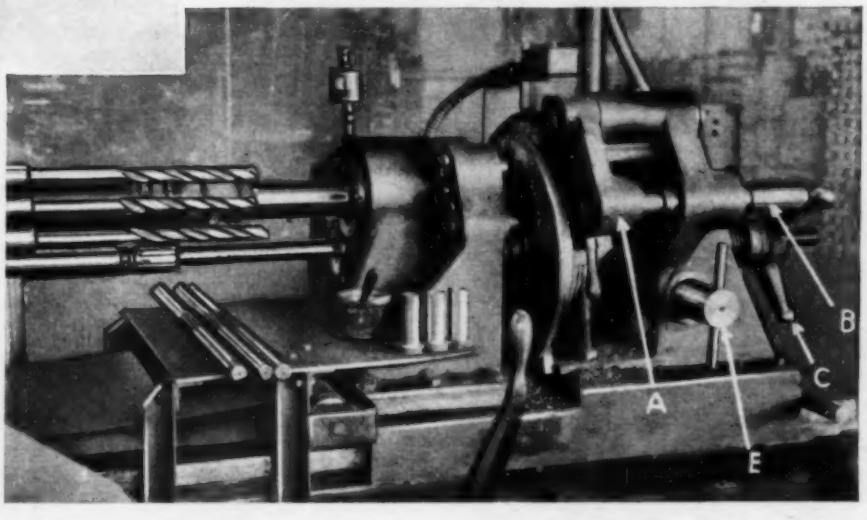


Fig. 2—This special fixture is set on the base of a horizontal, mechanical-feed boring machine. The large bar at the rear carries two fly cutters, a reamer, and a collapsible die. Substitution of the three reamers shown on the table is made for the three drills in front

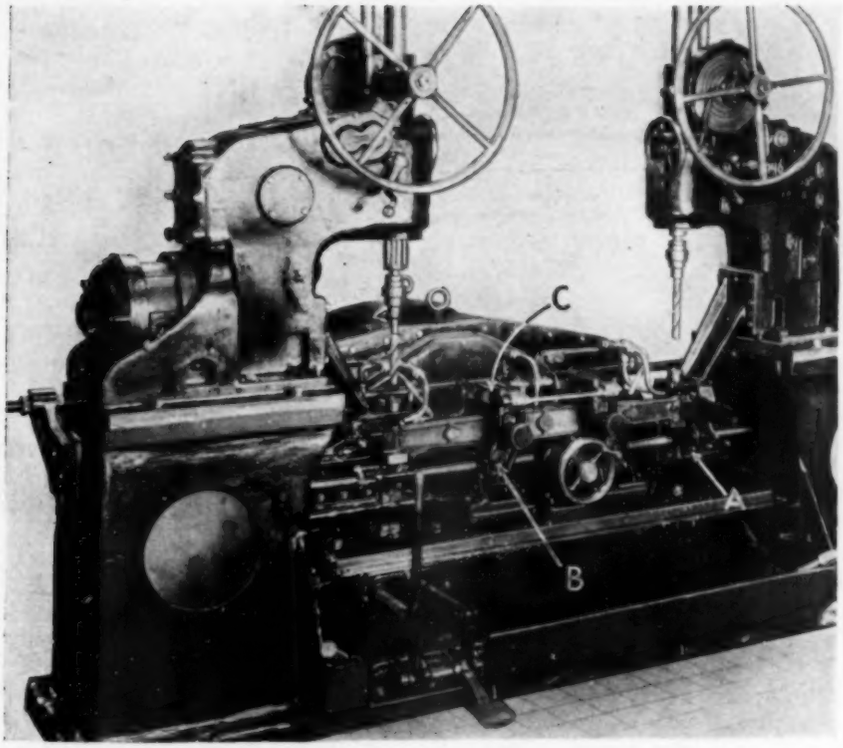


Fig. 4—(Above) Combination machine in which the front axle is completely drilled. The two side heads drill and ream the kingpin holes, while the rear head, hydraulically fed, drills five holes in the sides of the piece

Fig. 5—(Below) The cast-iron differential center is made in two pieces bolted together. A section of a sphere forms the internal surface. A four-armed spider carrying the bevel pinions rests in the four equally-spaced holes

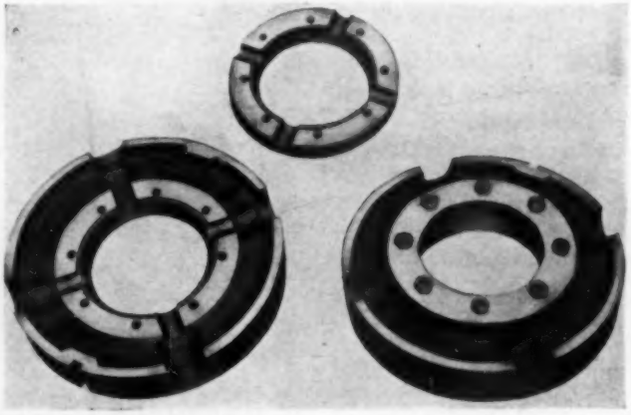
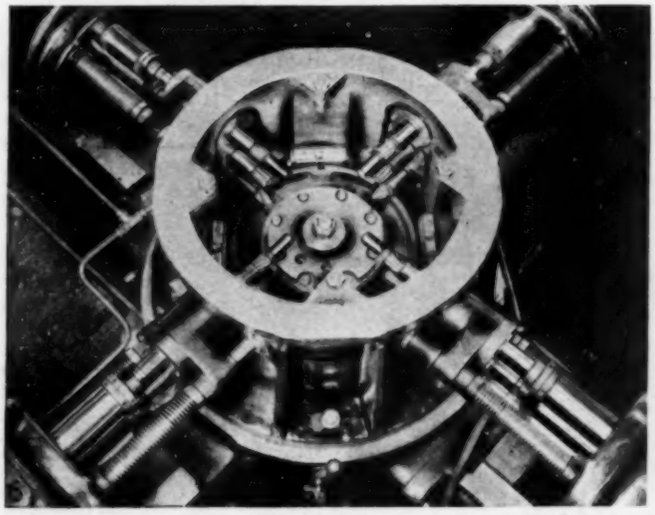
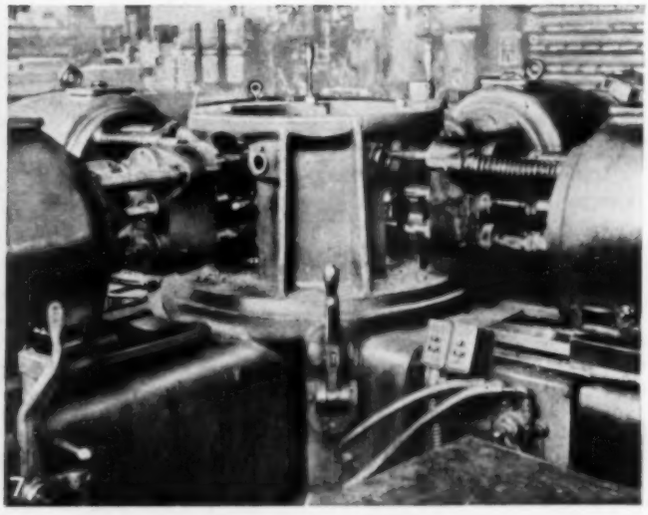


Fig. 6—Top view of the special fixture in which the differential center is held while the four spider holes are drilled, rough reamed, and finish reamed. The four heads are advanced simultaneously and at equal speed through an equalizing mechanism

Fig. 7—Side view of the same fixture shown in Fig. 6 The work is raised pneumatically in three stages corresponding to the tool centers. Ball-bearing guide bushings are used to advantage





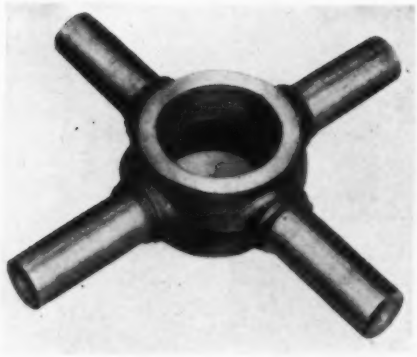


Fig. 8 — Semi-finished differential spider forging. All four arms must be in the same plane within 0.002 in. and within 0.002 in. on center to center at the ends

While it is obviously advantageous to perform as many operations as possible in a single set-up of a large and complicated casting, in the past it has not been usual to find this procedure being practiced on a relatively small casting, such as the one shown in Fig. 1. This is the transmission case head. The chief reason here is to assure the proper relation of the various holes. In the set-up shown in Fig. 2, not only are different tools substituted in the work spindle, but tandem tooling also is employed on two spindles to take advantage of the full cutting time of the other tools. For example, while the three drills shown in the foreground are penetrating first the main head and then the bracket cast on one side to support the shifter bars, another and larger hole is being rough and semi-finish bored with fly cutters, then reamed to 1.625 in. These tools are all on the same bar. Similarly, the largest bar carries not only two boring tools and a shell reamer, but also a collapsible die for threading a hole 3.585 in. in diameter., 12 th. per inch, so that positive alignment is secured.

After the three shifter holes are drilled, they must be reamed. This is done by interchanging the drills with the reamer bars shown on the machine shelf and substituting another set of guide bushings for the drill bushings. At this point it should be mentioned that the drills are guided by a second set of bushings when penetrating the bracket. These bushings, which obviously offer no support for the reamers, are carried in arm *A*, Fig. 2, which is swung down into position after the casting is in place and is locked by pin *B* with the knurled handle. During the reaming operation this swing arm is withdrawn.

Positioning of the casting itself is by the previously reamed central hole, 3.544 in. in diam. It is held on a movable arbor through the medium of a draw bolt and C-washer. The draw bolt is tightened by a capstan wheel *C* backed up by a helical spring which is designed to pull the piece "home" when it is tapped with a mallet. By means of capstan *E*, Fig. 2, the stud can be rapid advanced to the loading position, loaded, and then withdrawn until the flange of the case strikes a stop. An index pin engages one of the holes previously drilled in the flange, and in this way stabilizes the casting against rotation on the arbor. In addition, an adjustable stud, set on the table in a vertical position, bears against the side of the bracket and clamps the work circumferentially.

The particular machine in which the multiple-spindle drill head is mounted is driven by a single motor through a quill arrangement. One set of speeds is provided at present, although by slight modifications an additional speed could be obtained for reaming. Rapid traverse is available in either direction through the medium of twin-disk clutches. Two feeds are provided, one for boring, the other for tapping.

The front axle forging, shown in Fig. 3, is completely machined in only two set-ups, the first, in which the kingpin boss faces are straddle-milled, the second, in which the kingpin holes are drilled and reamed, the locking pin holes drilled at right angles to them, and the two radius rod and the pivoted center link holes drilled in the side. As in the previous example, in order to perform all these drilling and reaming operations in the same set-up, a special machine had to be built up from standard units and certain of the tools, the reamers, have to be substituted for the drills in the latter part of the operation.

As can be seen in Fig. 4, the drilling machine is built up of two 20-in., single-spindle, vertical production drills with mechanical feed, and a horizontal side head at the rear. The latter carries five spindles and is fed hydraulically by means of an Oilgear pump and cylinder. When the machine was built, an adjustment of $\pm \frac{1}{2}$ in. was provided on the two outside spindles to compensate for variations in the length of the axle forgings. Adjustment is also available on the side head spindles. Actually, however, no resetting has been found necessary as the forgings are selected to within $\frac{1}{16}$ in. of size.

The forging is SAE 1045 steel, normalized at 1,500

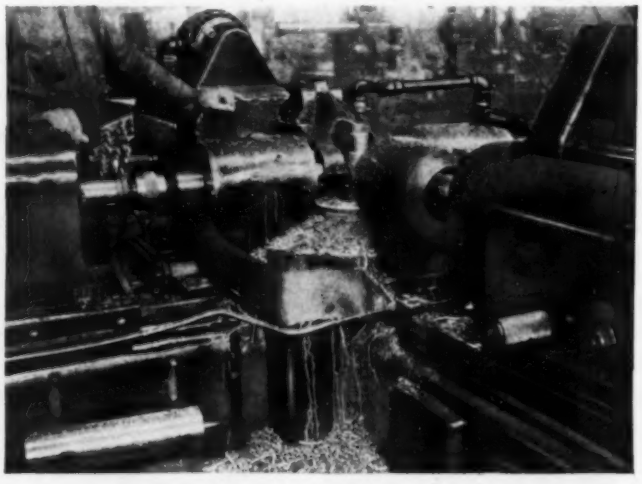


Fig. 9—Close-up of the tool hands employed on a four-way hydraulic-feed machine for hollow-turning and centering the arms of the differential spider. One of the centering bars may seen in the lower left-hand corner

deg. F. It rests on hardened blocks bearing against the lower, milled kingpin hole faces at each end and is clamped endwise by V-blocks *A*, Fig. 4, advanced by right- and left-hand screws through miter gears and the handwheel shown at the front. A slight amount of play is given the V-block to compensate for any twist in the forgings. Additional side clamping is obtained by two independent swing clamps *B*, carrying setscrews with knurled handwheels, in conjunction with the upper arms *C*. These arms, which are swung down in unison, carry knife edges that bear against small V-blocks in the lower clamp arms and furnish the necessary reaction. The screw pressure reaction on the piece is taken through two steel plates bearing against lugs forged at each end of the axle. A splash guard, not shown, is placed in front of the fixture to confine the coolant spray.

In operation, the horizontal side head is rapid advanced and fed into the work, and upon its withdrawal, the vertical spindles are rapid advanced by the large handwheels, the feed engaged, and the kingpin holes drilled. Reamers are then substituted for the drills, guide bushings are interchanged, a lever is thrown to obtain a higher spindle speed and the reaming operation is performed. Floor-to-floor time is about 4½ to 5 min. a forging.

Another production problem that was solved with the use of special-purpose equipment was that of drilling and reaming four 1¼-in. holes in the cast-iron differential center, shown in Fig. 5. It is these holes through which the differential spider, or cross, extends, and they must be at right angles and in the same plane within 0.0015 in. The unit is made in two parts bolted together as shown, the centers of the holes being on the dividing plane. It is important that these centers coincide with this plane and with the center of the spherical inside surface, 7.875 in. in diam., against which the differential pinions bear. A four-way horizontal drilling machine with hydraulic feed was chosen to do the work, which is performed in three stages; drill, rough ream, and finish ream.

In Fig. 6 a close-up of the fixture is shown from above, while Fig. 7 gives a side view. As can be observed, each unit head carries three spindles, the lower being the drill spindle. Extended in front of each head is a guide bushing carrier which is registered against the fixture face by two pins and bushings, and which slides on rods against spring pressure. Both the drill bushing and the reamer bushings are mounted on ball bearings. The work is mounted on a vertical ram advanced pneumatically in three stages, the distance between spindles being 3¾ in. Positive stops are provided for the end positions and, for the central one, location is by a pawl and ratchet piece actuated by a lever at the operating position.

The work rests on a steel plate which fits an inset shoulder in the piece, 10⅛ in. in diam., and it is clamped with a nut and C-washer through a similar plate resting on top. Both these plates are drilled out to clear the bolts holding the two parts of the casting together. Circumferential location is by a fixed pin that engages either one of two holes cored in the web at diametrically opposite positions. No greater accuracy of location is needed, since it is the relative and not the absolute position of the four holes that counts. Accuracy for the finish reaming operation is further assured by an additional set of forward guide bushings found grouped around the clamping column and inside the hollow portion of the work when it is clamped in position.

A single Oilgear pump operates all four unit heads of the machine, and in order to equalize the travel of each, four racks fastened to each head engage a common, hollow gear, mounted concentric with the work-holding ram, which passes through it. One of the heads carries dogs on the side that engage trips which control the cycle of all four heads.

The special unit built for machining the differential spider, or cross, is somewhat similar in construction and in principle of operation to the unit just described although the tooling is very different, necessarily. This is also a four-way machine, equipped with Oilgear feed from a single pump, and the same type of equalizing racks is employed. Fig. 8 shows the completed forging, while Fig. 9 shows a close-up view of the heads. The spider measures about 10½ in. overall and the four arms are 1¼ in. in diam. The material is SAE 2320 steel, normalized at 1,700 deg. F. In this unit the arms are hollow turned and in a latter operation are centered at the ends.

Before the forging reaches the machine, the hub has been faced on both sides in a turret lathe. After the hollow turning operation, which follows, the piece is carburized to a depth of $\frac{1}{16}$ in., but before being hardened, the ends are milled off to leave them in a soft condition so that the centering can be done. The centers are used for setting-up the forging for finish grinding,

Fig. 10—The steering knuckle of the Model U tractor is forged from SAE 1045 steel. It is shown after it has been straddle milled between the yoke arms, the steering arm boss milled, and the kingpin holes drilled and reamed. All turning operations on the spindle are performed in one set-up in an automatic Multi-cut lathe

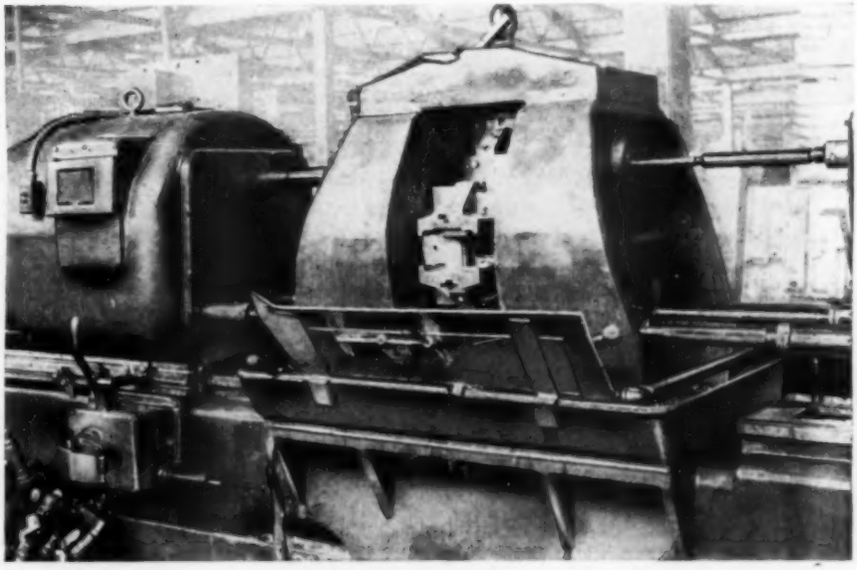


Fig. 11—Special four-station rotating fixture in which the steering knuckles are drilled, reamed, and finish reamed. Standard unit drill heads with hydraulic feed are employed. Indexing is by hand

and the centering operation is done after heat-treatment so as to offset distortion.

By means of a special pneumatic chuck the work is rigidly clamped between two plates resting against the finished hubs so that the center-lines of the spider arms are in the same plane as the cutter bars, and at the same time the forging is centralized about its vertical axis by a spring-actuated taper plug. In order to make this method a success, it is necessary that the forging be held within reasonably small limits and that it be pickled free from scale. The four cross arms are lined up with the cutter spindles by means of a Y-shaped swing arm carrying a set of V-blocks. These Vs engage a set of opposing cross arms, and, besides centralizing the forging, they serve to steady it during the early stages of the turning operation. The same fixture is used to line up the piece for the centering operation.

Interchangeable bars, 4 in. in diam., are used for the hollow turning and the centering, and they are connected to the machine spindles through Oldham couplings. For turning the arms, a single high-speed steel cutter is used, set in a slot at an angle of 30 deg. to the axis of the bar; opposite it is a pair of hardened steel rollers which trail the tool nose by $\frac{1}{16}$ in. The centering drill is mounted in a standard collet with taper shank fitting directly in the second bar. Hardened steel sleeves guide the bars, these sleeves in turn being carried on ball bearing sleeves. Only 0.0005 in. running clearance is allowed between the bars and the guide bushings. With this set-up, it is possible to machine all four arms in the same plane within 0.002 in. and within 0.002 in. center to center at the ends. One of the principle reasons why this accuracy can be maintained is because there is no chance of springing the work during the turning operation since all the tools are in line and the individual cutter loads are balanced.

Another special-purpose unit is the one in which the kingpin holes are drilled and reamed in the steering knuckle. This piece, Fig. 10, is drop-forged from SAE 1045 steel and is normalized at 1,500 deg. F. before entering the tractor shop. The first machining operation is to straddle-mill the inside of the yoke and both sides of the steering arm boss so that the finished surfaces produced will serve as locating points in positioning the forgings in the chucks for the drilling operation that follows. As can be seen in Fig. 11, a special indexing fixture is the feature of the machine, which is made up of a standard bed and two unit heads, each with integral motor drive. Because of the very nature of the work, only one set of spindle speeds need be provided. An Oilgear pump and rams are used to rapid advance, feed, and return the tools. A dwell position is also provided in the event that a facing operation is desired.

Three tool spindles are mounted in each head on a pitch circle of 48 in., and four chucks are provided on the indexing fixture, which is mounted on tapered roller bearings so that it can be readily revolved by hand from station to station. Three of the stations are work positions; the other, a loading position. In the first station, the forging is drilled to a diameter of $1\frac{3}{8}$ in., followed by a rose reaming and a finish reaming operation in the next two stations. With an operator working rapidly, the floor-to-floor time is about 1 min. 40 seconds.

Each chuck has two movable jaws and is hand operated. One jaw pivots so as to act as an equalizer, both being faced with hardened tool steel plates, coined out to the shape of the forging. The non-equalizing jaw also carries another plate that snuggly fits the milled inside faces of the yoke and serves to position the piece positively. The spindle shank of the knuckle extends through the hollow center of the chuck toward the middle of the fixture.

On account of the heavy loads imposed, live drill and ream bushings are used, mounted on ball bearings. Each yoke arm is drilled simultaneously, but separately. Special precautions were taken, therefore, to line up the live bushings accurately, and, as a further aid, Oldham jaw couplings connect the tool bars with the head spindles so that misalignment is obviated.

Support for Machine Tool Research

By John Edwards

"SHOPWORK," so-called, has long been on the decline in technical schools. Educators in close touch with industry are saying, more and more, that college is no place to learn the routine technique of tool handling and machine operation. "Industry can do that job better than we," they say, "and leave us more time to instill the engineering fundamentals."

This trend, known to all who keep in touch with the technical colleges, does not mean the elimination of the machine tool from technical curricula. Quite the contrary! Many machine tools are going out of the college shops to the junk man, it is true, but their place is being taken in a better way by other machines coming in by the doors of the research and testing laboratories.

Testing and analysis are replacing routine drill in operation. The student investigates the effect of tool angle, position, feed, depth of cut, and kind of material on thrust, torque, and power. He learns to think in terms of the elements which ten years from now will be recombined in new ways, in designs now unknown and undreamed of. And, to a limited extent, the machine tool has become an object of research by graduate students and professors. This phase of the matter, which is still in its infancy in America, deserves far more attention from our machine tool builders. Many fail to grasp its vital relation to the future prosperity of the industry.

It is significant that some of the best machine-tool brains in Germany are to be found, not in industry, but in university research laboratories. In cloistered seclusion the foundations are being laid for technical advances that will mean increased competition for American manufacturers. Machine tools are no exception to the rule that today's research will largely determine tomorrow's practice.

In the face of this real threat, American manufacturers seem to exhibit little but apathy toward machine-tool research, particularly in the universities. The contrast with the attitude in other branches of mechanical engineering is marked. College laboratories find no difficulty in obtaining steam and oil engines, condensers, and other power equipment for purposes of research and instruction at shop cost or even as outright gifts.

Not so with machine tools! The director of one of America's finest engineering laboratories, after contacting with the leading machine-tool manufacturers, found not one to offer the slightest concession on machines for research purposes. Naturally, tool research will lag at this university and others until manufacturers take a more far-sighted view of the situation.

IDEAS FROM PRACTICAL MEN

The department, "IDEAS FROM PRACTICAL MEN," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit.

Concavities, Convexities, and Ovals

Attachments Mounted on a Lathe for Turning, Boring and Grinding Parts for Oval Dies

The final section of the series.

IN TURNING convex and concave surfaces we were dealing with an operation where the work revolves continuously about its axis, while the path of the tool point is the resultant of a travel radially toward the axis of rotation and a travel parallel to this axis.

In elliptical work the path is produced by revolving the work and simultaneously reciprocating it in a path perpendicular to its axis of rotation. In one case the work is stationary on its axis and the tool moves, in the other the tool is stationary and the axis of the work changes.

BY FRANK W. CURTIS

IN MAKING press tools for oval cans, such as are used as containers for kippered herring, the die parts must be made to the same shape as that of the can to be produced, and all must be finished to close limits. Equipment for boring, turning and grinding oval surfaces has been designed and built at the San Francisco plant of the American Can Company, for use on an engine lathe.

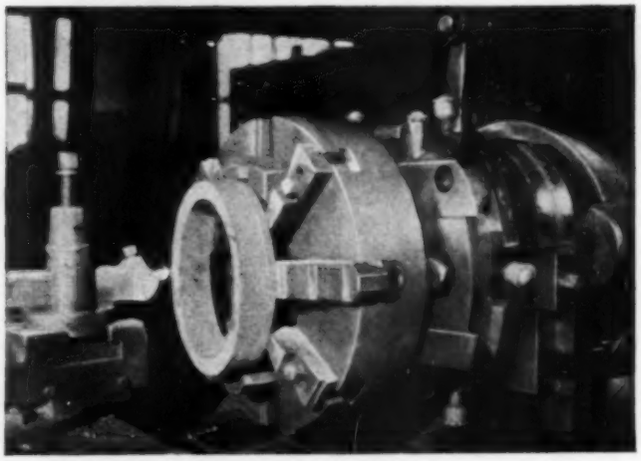


Fig. 1—Set-up on a die for a can top, either oval or annular shapes may be machined without changing chucks

A set-up for boring and turning oval parts is illustrated in Fig. 1. The part to be machined is held in a four-jawed chuck mounted on the oval attachment. A drawing of the attachment in place on a lathe is shown in Fig. 2. The main parts are the slide *A*, the slide holder *B*, the eccentric strap *C*, the adjustment plate *D* and the lathe plate *E*.

The slide holder is attached to the machine spindle and revolves with it. The lathe plate is a stationary member and is fastened to the headstock of the lathe. On this part is mounted the adjustment plate, having a limited amount of movement horizontally at a right angle to the spindle. On the outer side of the adjustment plate is machined a concentric projection on which the eccentric strap fits. The eccentric strap is attached to the slide by two studs and nuts at *H*, so that it revolves with the rotating members. When the adjustment plate is moved so that the projection is off center, the projection becomes a stationary eccentric, and the eccentric strap and the slide are given reciprocating motion in relation to the slide holder, the amplitude of which can be controlled to suit the proportions of the oval desired.

The eccentric strap is made in two parts, so that it can be assembled

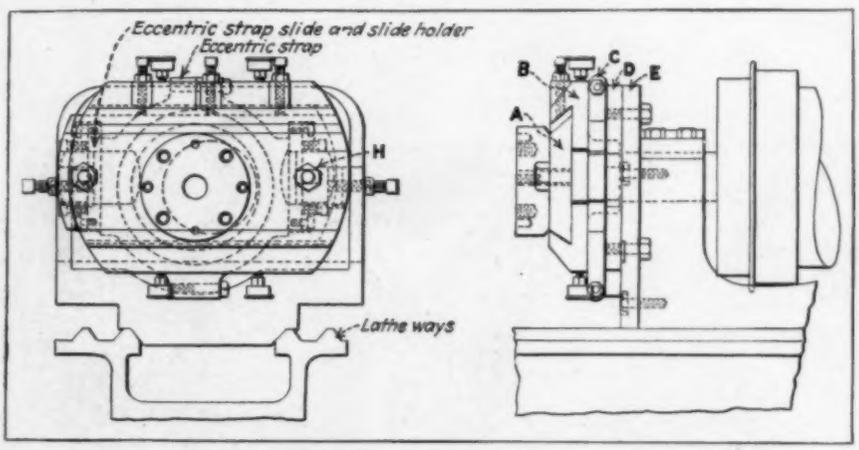


Fig. 2—Details of a lathe chuck mounted on a slide. An eccentric reciprocates the slide and in combination with rotation generates an oval motion

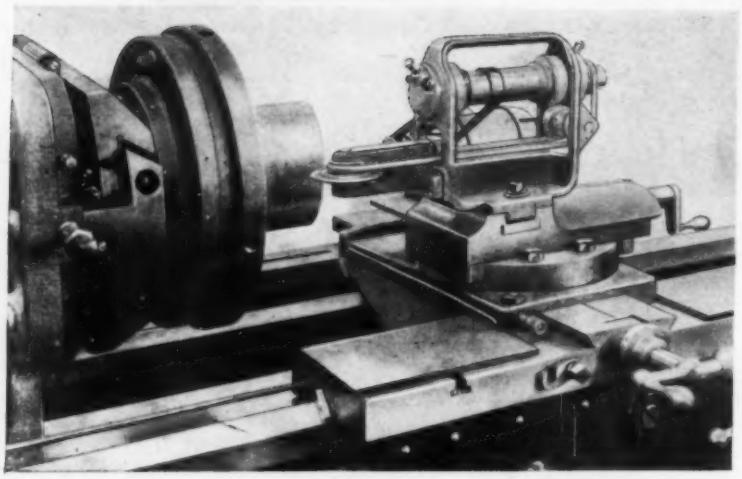


Fig. 3—Grinding chuck for grinding oval shapes. The wheel in this example is horizontal

conveniently after the slide and the slide holder have been attached to the spindle of the lathe. In addition, it is fitted to slide at a right angle to the slide and the slide holder, otherwise the device would be inoperative. The slide is confined in the slide holder by a gib, so that a satisfactory sliding fit can be maintained. Four grease cups are mounted on the slide holder, so that all moving surfaces will have proper lubrication. Another feature of the attachment is that there is an auxilliary adjustment between the eccentric strap and the slide, so that the slide can be shifted one way or another, should the work require it. In some cases, especially in turning rough forgings, it is necessary to shift the work slightly in order to have it clean up. This method of adjustment is not always used, however, since the independent four-jawed chuck permits the work to be shifted by moving the jaws.

The same oval attachment is used in connection with grinding, and in Fig. 3 it is shown with a die part in place. In this case the work is mounted on a stub arbor projecting from a special faceplate, so that any adjustment must be made by moving the slide on the eccentric strap. One of the main requirements in using the attachment is to have the wheel directly at the center height. The same rule holds true for the tool in turning. The location of the work is checked by an indicator, the point of which bears against the oval surface. The operator merely revolves the work a complete turn and observes the indicator readings to determine whether or not it is properly located.

By Clifford H. French

OVAL DISHES are favorites with many housewives, and molds must be made for a large variety of such forms to meet different requirements. Oval molds for Pyrex glassware as made by the Corning Glass Works, Corning, N. Y., are machined on the Bullard boring mill shown in Fig. 1, on which an oval chuck has been mounted. While such a chuck is not new, the details of its construction are of interest, and may be of service in other work where oval turning and boring is required. Details are shown in Fig. 2 and the same letters designate the same part in both illustrations.

The table of the machine is shown at *A*. At *B* is a bracket bolted to the front of the machine base to support the front end of the sliding or eccentric table *C*, while a smaller bracket at the back supports the other end of *C*. Driving block *D* is bolted to a false table that fastens to the table of the machine, this construction making the oval attachment complete in itself. This driving block is of dumb-bell shape, as shown in the plan view, and drives the chuck or auxiliary work-table *E* by means of a long, hardened block working in slides underneath *E*, Fig. 2.

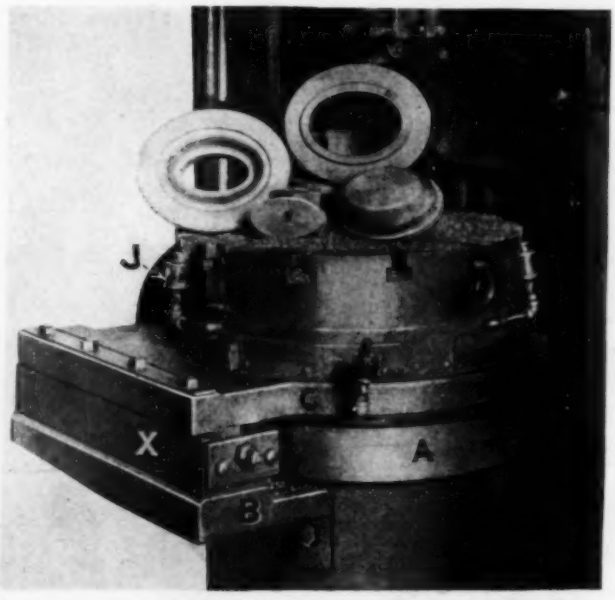


Fig. 1—Bullard boring mill equipped with a chuck for machining oval shaped molds for glassware

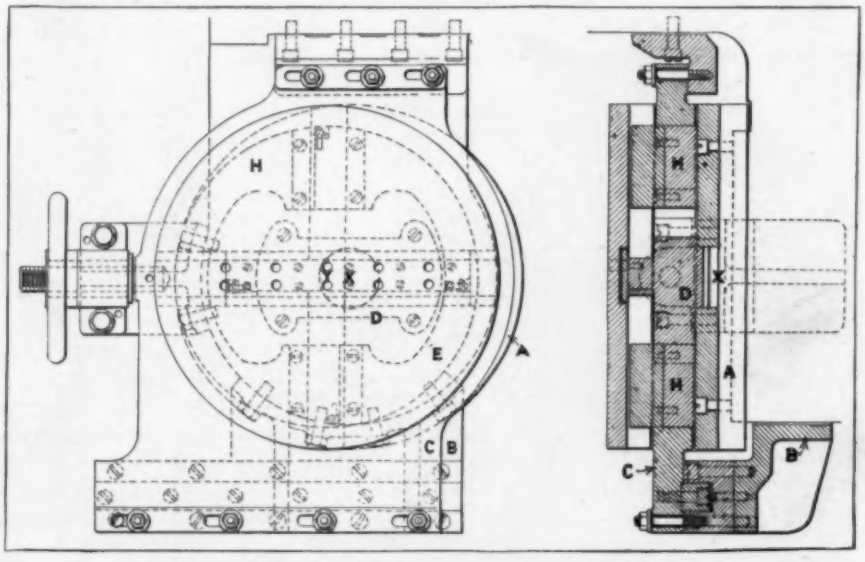


Fig. 2—Details of the chuck used for boring and turning oval shapes. It differs considerably from the one used for lathe work

These slides are fitted with gibs at each end to take up wear and prevent lost motion between the parts.

Inside of the stationary plate *C* is a disk *H* with its movement directed by the position of the plate *C* with relation to the table of the machine itself. The plate *C* also carries two sliding ways at right angles to those on block *D*, as seen in Fig. 2. These two sets of slides form what is in effect on Oldham coupling.

With both the machine table *A* and plate *H* concentric, the machine will bore or turn a circle. With the plate *C* moved off center by the screw controlled by handwheel *J*, the distance between the center *X* and *Y* determines the amount of the oval secured, considerable variation being possible. Two varieties of ovals are shown by the molds on the table in Fig. 1. Both sets of slides are provided with gibs and the whole construction makes a very substantial accessory to any boring mill or lathe in shops where work of a similar nature is to be done. As constructed it is capable of handling a large variety of work, of taking cuts that put it in the class of production tools. For polish and finish, a flexible shaft outfit is used. Where accuracy is required a grinder is fastened to the boring heads.

Jig for Drilling Holes in Mica

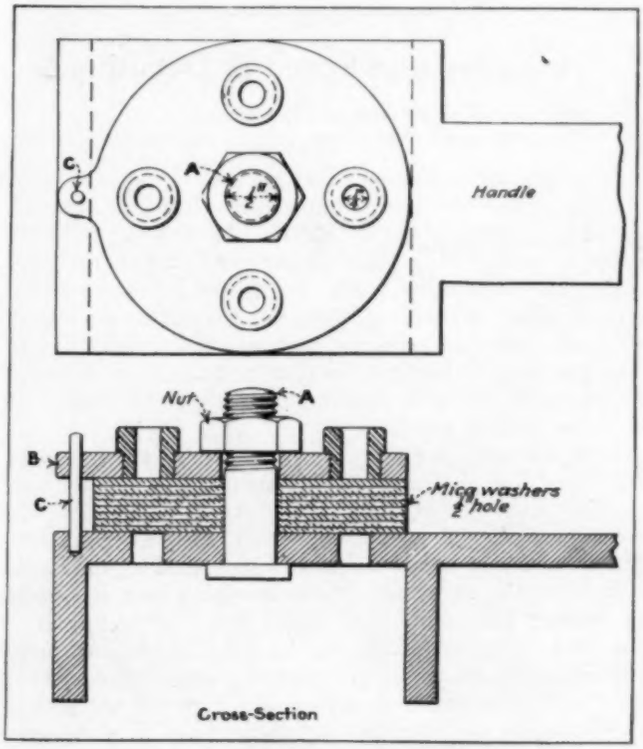
By H. N. Kirk
H. N. Kirk & Company

For a recent order, we required a quantity of five-hole mica washers. The outside diameter was 3 in., the center hole being ½ in., and the 4 edge holes ¼ in. in diameter. First, each washer 3 in. x ½ in. was punched singly in a power press by a standard die of this size.

These washers, to about ½ in. in thickness, were placed on the center pin *A*. A plate *B* with four hardened bushings to act as drill guides, was put on the center pin and the guide *C*. Then the nut was tightened, so that the washers were clamped solidly.

The washers were then drilled, as called for. This idea can be changed to suit odd shaped washers, by using guide pins to keep the mica pieces in line.

Such jigs save the expense of a complicated die where only a few hundred pieces are wanted at a time. It differs from other drill jigs only in the fact that the mica must be clamped tightly before drilling, and no clearance is left between the drill bushing and the work.



Jig for drilling mica washers

Set-Ups for Machining Crossheads

By George H. Feltner

In machining crossheads at the Sacramento shops of the Western Pacific Railway, the first four operations are boring and reaming the taper holes for the piston rods, turning the hubs, and cutting the keyslots. The

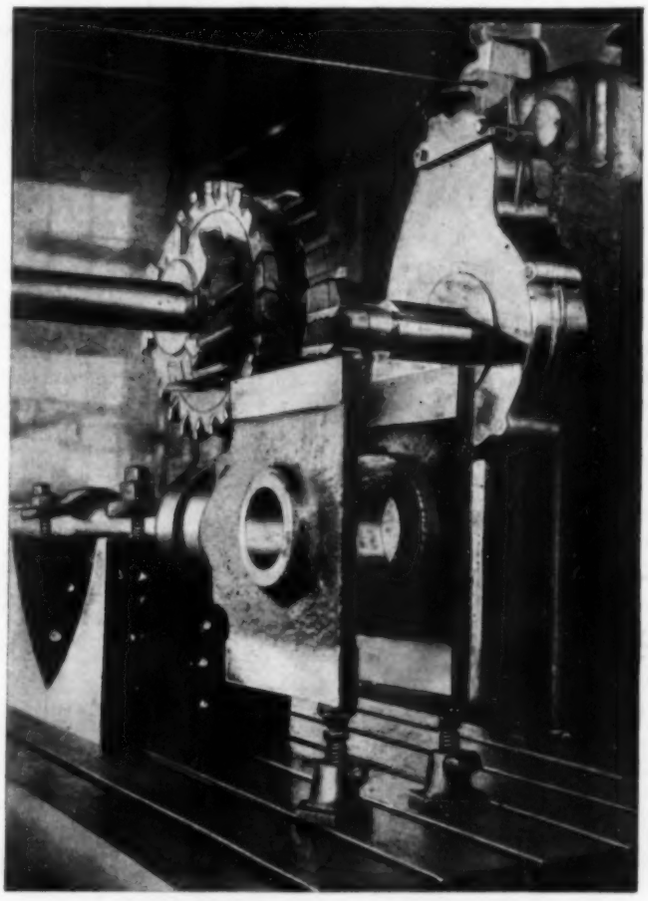


Fig. 1—Milling the surfaces for the shoes

balance of the work is done after the crossheads have been mounted on the piston rods. An assembled unit is mounted on the table of a horizontal boring mill, the piston rod being clamped in V-blocks for alignment. The crosshead is supported by jacks, as shown in Fig. 1, and is held by strap clamps placed directly over the jacks.

Four inserted-tooth cutters are so arranged on the arbor that they machine the inside faces and the edges of one side at the same setting. For machining the outer faces, the larger cutters are reversed and properly spaced. The inner faces of the bosses of the pin holes are milled

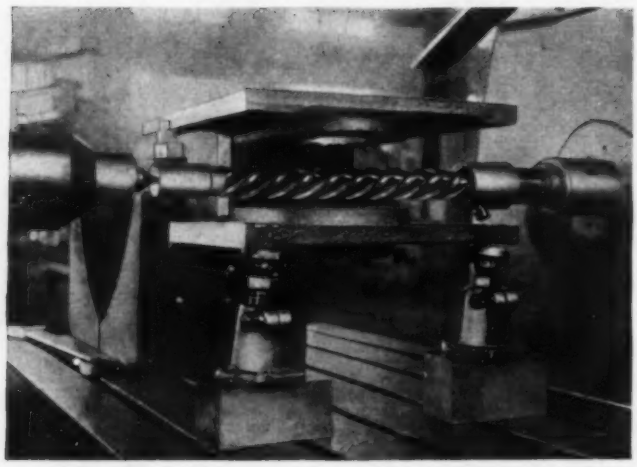


Fig. 2—Milling the insides of the pin bosses

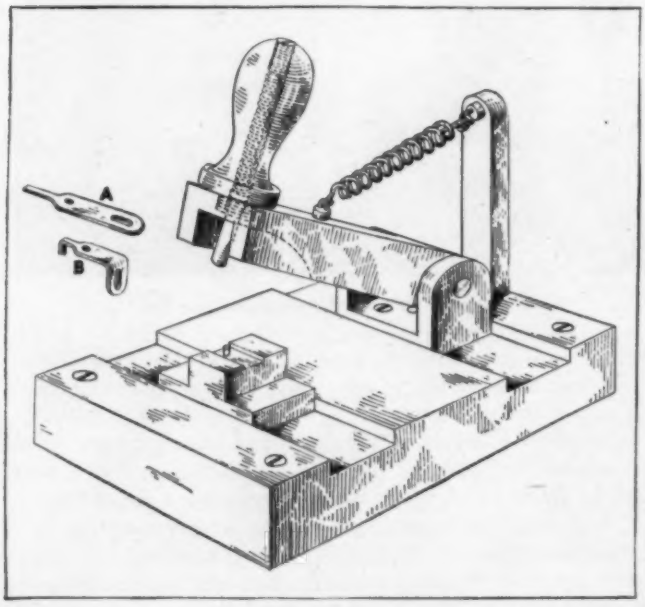
by a helical cutter, as shown in Fig. 2. For this operation, the work is rotated 90 deg. and is supported by two jacks mounted on elevating blocks. This method produces a smooth, level surface.

Bending Fixture for a Small Part

By Charles H. Willey
Asst. Plant Supt., Hoyt Electrical Works

Small pieces like the one shown at *A* were to be blanked and then bent as shown at *B*. They were to be made of $\frac{1}{64}$-in. brass in lots of from 1,000 to 2,000, with a possible chance for an order for 25,000 at a time. As the lots were small and the pieces were to be made from scrap, a progressive die was not considered. A simple die was made for the blanking and piercing, and the bending was done as a separate operation in the fixture shown in the illustration.

The piece is placed on a disappearing pin in the groove of the anvil, and the hinged bar is brought down, bending each end of the piece as shown at *B*. The pin in the hinged bar is actuated by a coil spring inside of the handle, as shown by the dotted lines, and holds the piece under pressure before the edges of the bending block touch it. After bending, the pin strips the piece. The hinged bar is held up by a coil spring. Of course, the bar is a snug fit in the saddle and has sufficient bearing to align it with the anvil. The tool was cheap to build, and a girl operator turned out 800 pieces per hour. Another job was thus kept out of the power press, perhaps saving fingers.

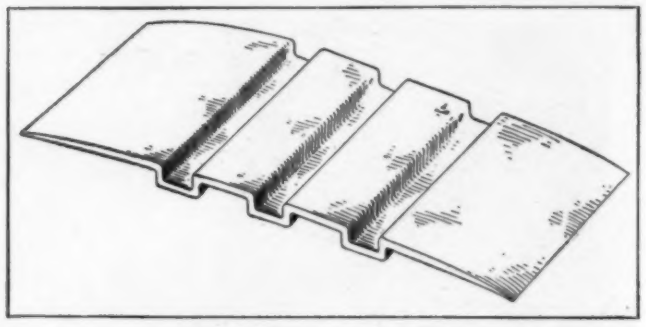


A simple bending fixture

Air Hose Protector

By Frank C. Hudson

This is a simple method of protecting air and water hose from damage by trucks in the shop. The plate shown is of boiler plate, bent with the three channels shown and the ends thinned down so as to allow the easy passage of truck wheels. The hose is simply dropped in either groove that is most convenient, the plate being wide enough to accommodate both wheels of an ordinary shop truck. This was seen in a Japanese railroad shop.



Protecting plate for air hose

Accuracy and Speed in Detailing

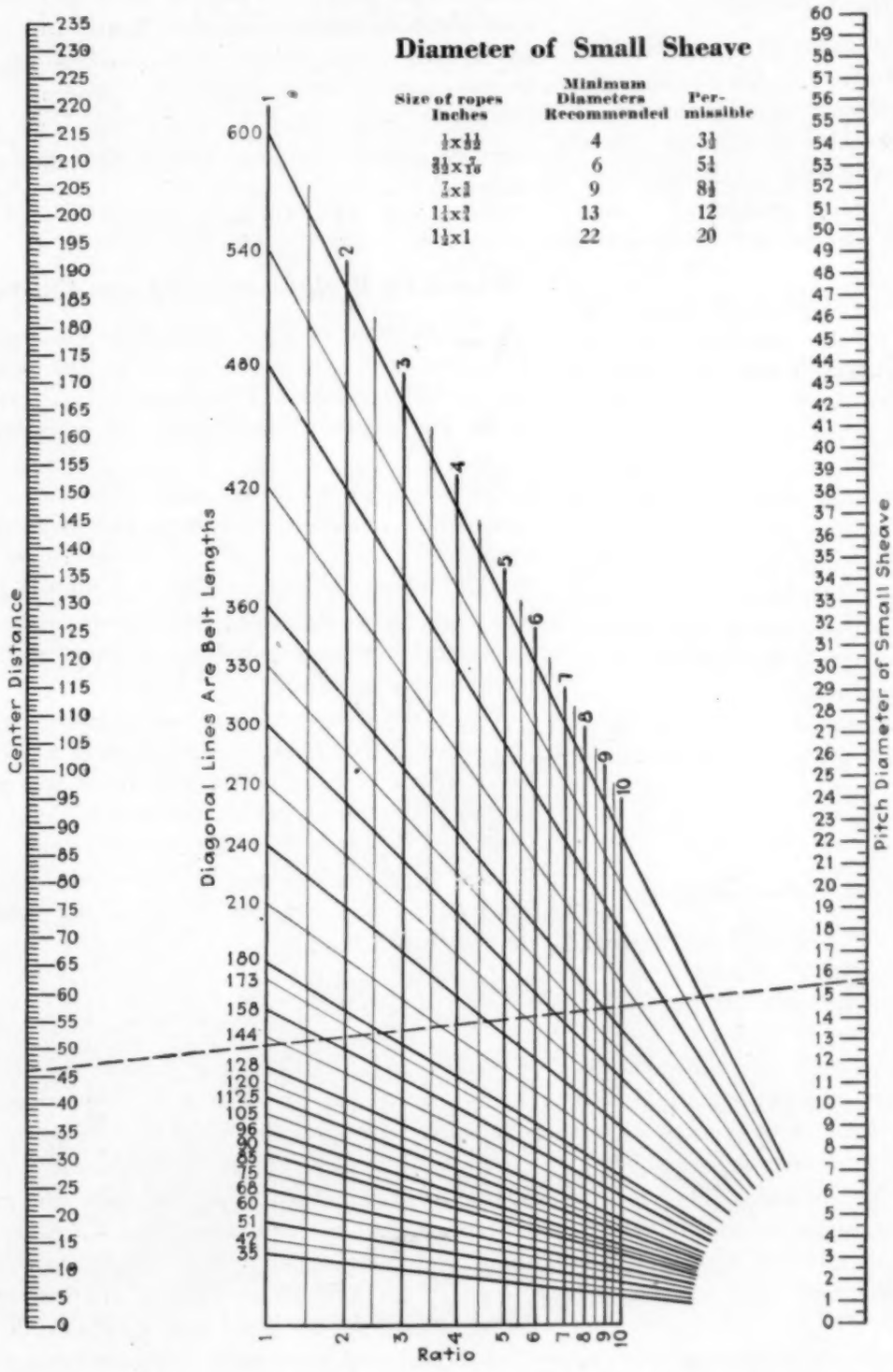
By George H. Gunn
Engineering Dept., Naval Aircraft Factory, Philadelphia

If details are drawn on paper such as is used for making blueprints directly from pencil drawings, greater speed and accuracy can be obtained by first covering the drawing board with square, cross-section paper. Such paper can be bought from any dealer in drawing materials. The inch-spaced lines on this paper are heavy, while the half-inch ones are medium, and the eighth-inch ones are fine. A line may be drawn to any desired length by counting the inch squares, or their subdivisions, on the cross-section paper.

This method eliminates the time lost in erasing overrun lines, and in transferring dimensions from the rule to the paper. Also, time can be saved in locating the centers of fillets or rounded corners, as the needle point of the dividers can be immediately placed at the intersection of the two lines. Cross-section paper is helpful in printing titles, etc., as no guide line need be drawn on the drawing paper. In laying out a series of dimensions, the cross-section paper prevents the accumulated errors that are often made in laying out a series of component lengths by transferring them from a scale onto the paper.

Chart for Finding Belt Lengths

V-Belt Short-Center Drives


Diameter of Small Sheave
Size of ropes Inches
Minimum Diameters Recommended
Permissible
1/2 x 11/32 — 4 — 3 1/2
3/8 x 7/16 — 6 — 5 1/4
7/16 x 3/8 — 9 — 8 1/2
1 1/4 x 3/4 — 13 — 12
1 1/4 x 1 — 22 — 20
Center Distance
Diagonal Lines Are Belt Lengths
Pitch Diameter of Small Sheave
Ratio

Given pitch diameter of the small sheave, center distance, and speed ratio: to find length of V-belt, place straightedge on the given points of small sheave diameter (right) and center distance (left) and note intersection with ratio line (middle). Interpolate between diagonal belt length lines to obtain desired length.

EXAMPLE: Dotted line drawn between points representing small sheave diameter of 15.65 in. and center distance 46 in. intersects ratio line 2.6 at diagonal line for 180 in. belt length.

The V-belt drive consists of a driving and driven sheave, grooved for a multiplicity of belts of trapezoidal cross-section. Power is transmitted by the wedging contact between the belts and grooves. At maximum load, repeated tests show an efficiency of 99 per cent and a co-efficient of friction of 1.5. V-belt drives operate, therefore, with comparatively small tension on the slack side, without slippage and with little creep. In figuring loads, it is usually safe to take 1.5 times the torque to get the total belt pull. Manufacturer's ratings must be consulted for selection of number and size of belts for given load conditions.

A V-belt drive will usually be well proportioned when the center distance equals or is slightly greater than the large sheave diameter. On small ratios the sheaves may be operated so closely together that the sheaves almost touch each other. Maximum center distance on 1/2-in. belts is 17 in., except on high ratios, where 25 in. is permissible.

In the accompanying chart, the sheave diameters are the pitch diameters, measured at the midpoint of the trapezoidal section of the belt when resting in the groove.

Information by courtesy of the Allis-Chalmers Manufacturing Company, Texrope Division

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American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

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New—From the Ground Up

IS THERE a works manager or superintendent who has not at some time in his life thought wistfully, and even dreamed, of what he would do if he had the opportunity of building a new shop and equipping it with new machinery from receiving dock to shipping platform? Such dreams, unfortunately, seldom get beyond the dream stage.

But sometimes such visions do materialize. One of them materialized for the production executives of Allis-Chalmers, and this issue of *American Machinist* is devoted almost entirely to an account of how they made the most of it. The story should interest the average superintendent or manager because this tractor plant is not so very big, and the number of tractors to be built is not so very great. In other words, the project is one that might conceivably fall into the lap of any shop executive. Consequently the editors believe that the departure from established practice represented by this assignment of one issue to one plant will meet with the approbation of the readers of the magazine. Comments will be welcome.

*

Labor-Saving and Labor-Making

COMMITTED as she is to the constant invention and development of labor-saving, hence money-making, machinery, it should be clear that America has equally constant need for the invention and development of labor-making, money-circulating devices and equipment. Given the former without the balance of the latter, and she might far too easily become a feudal industrialism, a nation of the jobless subject to the grudging largess and transient whims of concentrated wealth. Not too alluring a picture, nor one, thank the stars, that Americans are likely to permit.

At that, it may be timely to suggest to practical American inventors that in casting about for new things to invent, they conceive and develop new devices, new contraptions, and new gadgets to attract and stimulate the constant circulation of money out of the strong-boxes of the few into the pockets of the many. Let them not for an instant cease to invent labor-savers, but let them work also on money-circulators, luxuries and necessities which will both earn profit for themselves and provide work for other Americans who might otherwise be jobless. Those at work on pleasure cars, pleasure aircraft, pleasure boats, and radio are already making tremendous contributions, but let their efforts ever expand and prosper. Let inventors always keep in mind America's twin necessities, labor-saving and labor-making.

*

Worth Its Weight in Tungsten Carbide

A NEW expression seems likely to become current in the shop—worth its weight in tungsten carbide. Gold has long since lost its place as the standard of comparison. It is relatively cheap.

One result of the introduction of so valuable a material is naturally to arouse the cupidity of some of the less conscientious. A tool supervisor has just written in complaining that tungsten carbide tips are being stolen and bootlegged. He wants to know how to prevent it, usual tool-crib methods having failed.

When the demonstrators of tungsten carbide first started doing stunts and cutting materials that had never been cut before, there was some apprehension over what the safe-cracker might do with it. Not much has been heard of difficulties in that direction, but here is a problem inside the shop that must be solved. What are we going to do about it?

*

IN COMMENDING this special number of *American Machinist* to your attention, the editors desire to give full honor and credit to their associate, Frank J. Oliver, Jr., Western Editor, for initiating and carrying through the entire enterprise. Alone, and virtually unaided, he captured the imagination and the co-operation of General Falk and his associates. This complete and authoritative story of Allis-Chalmers Model U Tractor production more than warrants public recognition.

SHOP EQUIPMENT NEWS

LeBlond No. 5 ACL Automatic Crankshaft Lathes

TWO types of drives, namely, double end drive and center drive, are employed in the No. 5 ACL crankshaft lathes. These machines, which have been developed by the R. K. LeBlond Machine Tool Company, Cincinnati, Ohio, will turn the stub and flange and all main line bearings of eight-throw, nine-bearing crankshafts. To turn a crankshaft completely, the battery of machines necessary must include one machine of each type of drive and one crankpin turning lathe of the type announced two months ago.

After being centered and having the locating spots milled on the webs, the crankshafts are delivered to the double end drive machine illustrated in Fig. 1. The crankshaft is driven from both ends by the heavy air-operated pot chucks. These chucks are mounted on massive spindles that roll on Timken precision roller bearings. The equalizing feature of the chucks is designed so that it is impossible to spring the crank when chucking it. The double-end drive machine turns the Nos. 3, 4, 6, and 7 line bearings.

The crankshafts are taken from this machine to the center drive machine shown in Fig. 2. Here they are held on the webs by two special equalizing clamps, as shown in Fig. 3. The locatings spots *A*, Fig. 3, are finished so that the crank will not be sprung out of alignment. The crankshaft is located from the previously turned intermediate line bearings finished in the first operation.

The crankshaft is driven by both center units, and this feature reduces the torque to a minimum, since the load is practically the same on both halves. Drive is through ring gears, which mesh with pinions mounted on a large splined shaft. The large drive shaft rolls on Timken bearings, and is driven by a large gear which meshes directly with the motor pinion.

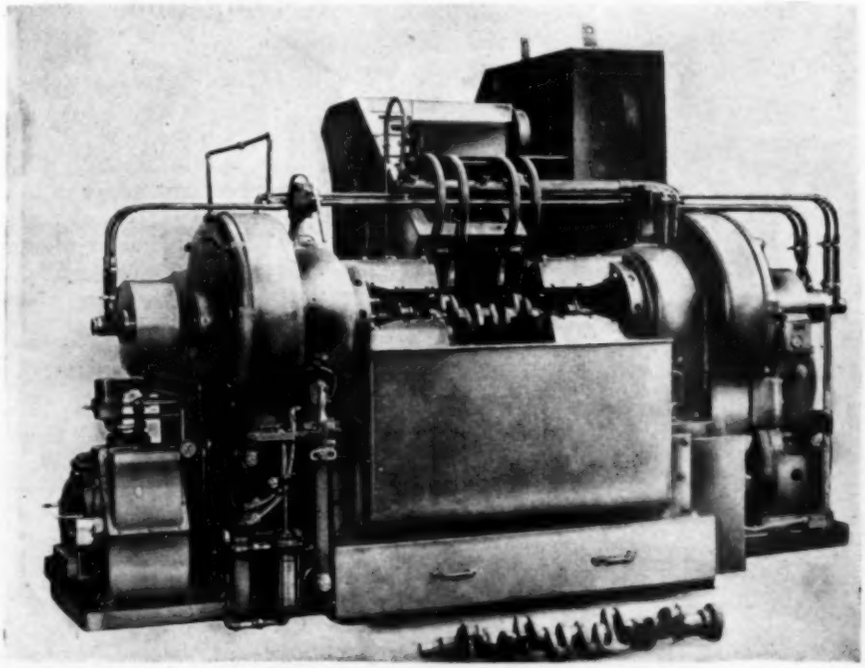


Fig. 1—LeBlond No. 5-ACL Double-End Drive Automatic Crankshaft Lathe. The crankshaft is driven from both ends and is clamped by the heavy air-operated pot chucks. The four intermediate line bearings are turned

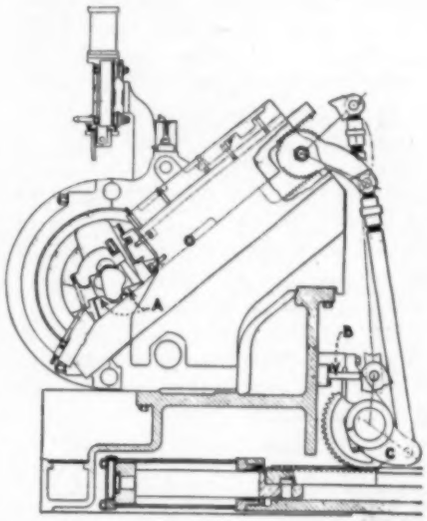


Fig. 3.—Diagram of the tooling and tool feeding mechanism on both machines. The tool bars are actuated by means of a toggle arrangement

The tools in the No. 5-ACL double-end drive and the 5-ACL center-drive machines are actuated in an identical manner. The general layout of the tool bars may be seen in Fig. 3. A hydraulic cylinder is located in a compartment in the center of the machine, and through a rack and segment, motion is transferred to a large shaft, which in turn actuates the tool bars by means of the toggle arrangement shown diagrammatically in Fig. 3 or pictorially in Fig. 4. This arrangement is merely a toggle motion. At a given piston speed, the feed of the tools decreases automatically as they approach the end of the cut. This feature gives a positive and powerful feed to the tool bars with a very large displacement of oil in the hydraulic cylinder.

As shown in Fig. 3, the front and rear tools feed toward each other. This feature reduces to a minimum the tendency of the crank to spring. Any side thrust is taken up by the extra-heavy bronze plates, which are rigidly secured to the massive unit base.

As it is necessary to have a dwell on a forming tool in order to repro-

duce sizes accurately, a positive stop, as shown at *B*, Fig. 3, is employed. When the segment arm *C* strikes this stop, the piston motion is stopped and the pressure built up to a predetermined point, after which a relief valve bypasses the oil into a small pot cylinder, which trips the Oilgear control and allows the Oilgear pump to be reversed and the machine spindle stopped. The Oilgear unit is stopped by means of a cam plate when the tool bars have traversed to the loading position. The spindle is stopped at a predetermined position by means of a dynamic control switch, which reverses the flow of current to the motor. A carpenter relay switch prevents the motor from running backwards by opening the circuit immediately after the motor stops.

Vertical Bit Tools Employed

The use of tools of the vertical bit type makes possible the removal and replacement of tools without changing the diameter setting of the machine. The front tool rough faces the webs and finish turns the bearing, while the rear tools do the cheeking and finish face the webs.

In the case of the double-end drive machine, it is impossible to start the machine if the air pressure falls below a safe minimum. Also, on both the double-end drive and center drive machines, it is impossible to traverse the tools into the work, since the cam plate acts as a positive lock to the power traverse.

To operate the double-end drive machine, the crankshaft is placed in the pot chuck and the air-operated center locates the crank. It is then clamped. The motor control switch is pressed to the starting position, and when released, drops back automatically to the running position. Traverse can then be engaged. The tools traverse to the work, feed to the proper depth, return to the starting position, after which the spindle stops automatically. The air valves can then be closed and the finished crankshaft removed, after which it is transferred to the second machine.

In the center drive machine, the operation is the same, except for the loading operation. The crank comes to this machine with the following line bearings machined: 3, 4, 6, and 7. The crank is then placed on the air-operated carrier shown in Fig. 2 and placed between the centers. The carrier is then removed, the centers adjusted, and the clamps locked in position. The cycle of operations is the same as that of the double-end drive machine.

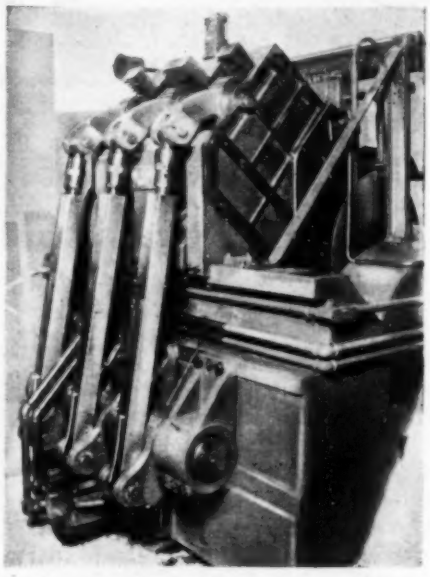


Fig. 4—Close-up of the tool bars, which are actuated by means of a toggle

Production is limited only by the possibilities of the crankshaft and tools. The normal production generally averages between 10 and 25 per hour, depending on the type of crankshaft.

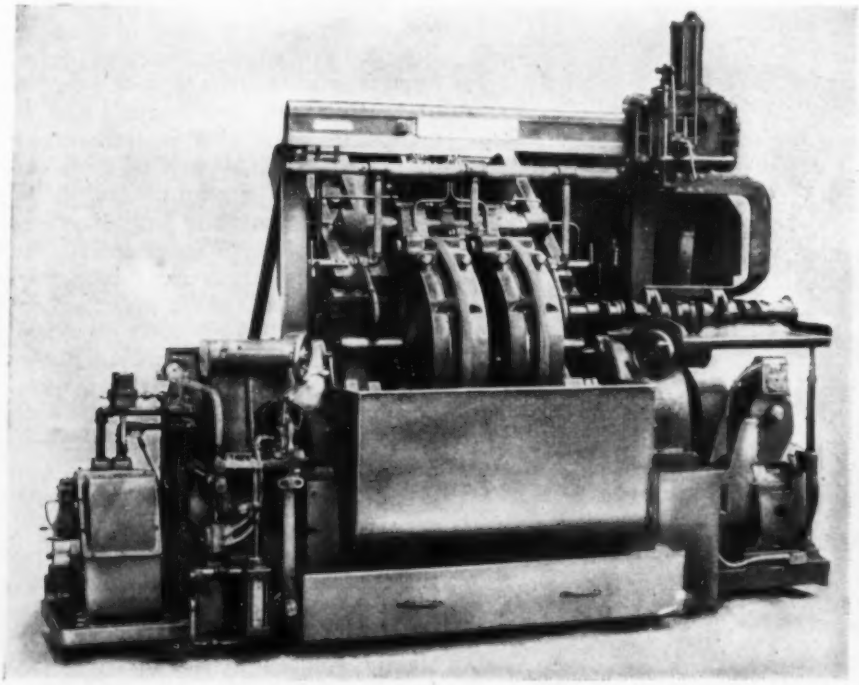


Fig. 2—LeBlond No. 5-ACL Center-Drive Automatic Crankshaft Lathe. The crankshaft is placed between the centers by means of an air-operated hoist, which may be traversed along the rail

"Weldite C" No. 6 Fluxed Welding Rod

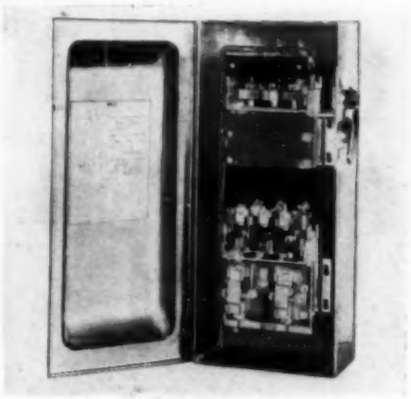
Intended for carbon arc welding, the "Weldite C" No. 6 fluxed welding rod has been announced by the Fusion Welding Corporation, 103d St. & Torrence Ave., Chicago, Ill. This rod is particularly adapted to the welding of mild steel plates and castings. It is said that the welding speed has been increased substantially, and that the deposit is strong and ductile, and readily machinable.

High Welding Speeds Obtained

By means of the flux coating on the welding rod, it is claimed that the operator can attain higher welding speed than is possible with the usual bare filler rod. This is because of the fact that the arc tends to pull from the hottest part of the weld puddle rather than jump to the colder edges. Sound and strong deposits have been made in the welding of heavy sections of mild steel. The ductile qualities of the deposits make it satisfactory for foundry work.

Condit Across-the-Line Starters

The standard a.c., across-the-line, air motor starters manufactured by the Condit Electric Manufacturing Corporation, Boston, Mass., are now equipped with hand-operated motor circuit switches, as required by the National Electric Code. For further security, both the starter and motor circuit switch will open at the same overload. Both are housed together in a sturdy safety case, which is easy to install.



Condit Across-the-Line Starter, which is equipped with a hand-operated motor circuit switch

The starters are furnished with or without fuse clips and meter test jacks. They are furnished up to 20 hp. for 550- and 440-volt circuits, to 10 hp. for 220-volt circuits and to 5 hp. for 110-volt circuits.

"Nacotex" Gasket Compound

For equipment having air, water, or oil connections, the National Cork Products Company, Newark, N. J., has announced a compound known as "Nacotex," which is essentially a gasket compound, but is neither a paste nor a cement. This material is not affected by oil, grease, kerosene, nor water, and can be used on ammonia and gas lines. It does not crumble, break, disintegrate, or become spongy, nor will it blow out when subjected to extreme pressures. High temperatures serve only to make it more tight and permanent.

Nacotex possesses a very definite "body," which permits building up to offset surface irregularities and depressions. It sets almost instantly and may be used in old or new gaskets or without a gasket on ground-fit joints. The material is supplied in tubes and in pint, quart, and gallon tins.

Oxweld Type W-17 Welding Blowpipe

A full-size blowpipe designed after the principle of the Type W-15 aircraft blowpipe, and designated as the Type W-17, has been placed on the market by the Oxweld Acetylene Company, 30 East 42nd St., New York, N. Y. This blowpipe is large enough for any welding job. Among the features are that the tip and welding head are of one-piece construction, being combined in a long and slender stem of the gooseneck type. Ten welding heads are furnished. The injector is located at the base or handle end of the stem. Each welding head has its own nut for attaching it to the handle of the blowpipe. The nut has been constructed so that it extends beyond the injector when the welding head is detached from the blowpipe, and serves to protect the injector from damage from careless handling. A fine pitch thread makes it possible to tighten or loosen the nut easily without the use of a wrench.

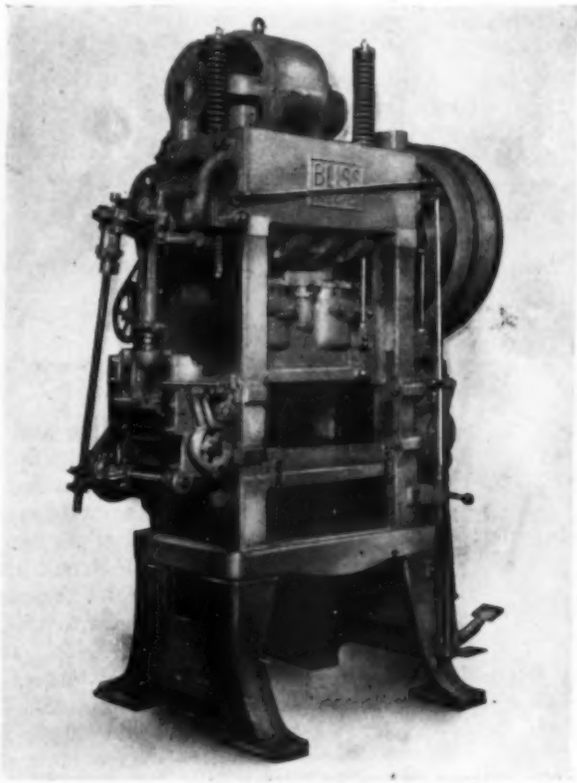
The handle of this blowpipe is made of special brass tubing having longitudinal ribs. This construction offers a sure grip to the operator and also reinforces the handle. The valve wheels are of an improved type, and are located so as to be accessible readily and yet out of the way during the welding operation.

The inner cone of the flame of the Type W-17 blowpipe is somewhat different from that obtained with any other blowpipe, it being shorter and thicker, and having a tendency to assume the shape of a ball at the end. This speeds up the rate of welding, because a larger portion of the high-temperature flame or inner cone surface is brought closer to the metal. The Type W-17 blowpipe is compact and light.

Oxweld Type W-17 Welding Blowpipe

Bliss High-Production Presses Equipped with a Scrap Shear

A scrap shear is now standard equipment on all high-production presses built by the E. W. Bliss Company, 53rd St. & 2nd Ave., Brooklyn, N. Y. The shear slide is driven from an eccentric on the extended crank-



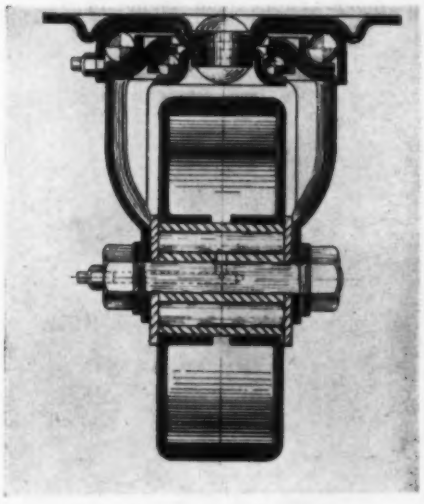
Bliss High-Production Press equipped with a scrap shear

shaft of the press through a standard ball joint connection. This eccentric is arranged so that the scrap cutter is timed 30 deg. behind the press slide, giving ample time for the pilots to locate the strip before the shear blades lock it. There is no necessity therefore for a hairline adjustment to synchronize properly the press slide and the scrap shear.

Regular press gibbing is used for the shear slide and take up screws are provided so that a tight sliding fit can be maintained. The upper shear blade is mounted in an adjustable holder similar in function to that of the table of a squaring shear. This adjustment makes it possible to obtain the fine clearance between the blades that is essential in cutting thin stock. A plate backed by springs holds the stock down tight against the lower blade to secure efficient cutting. The shear blades are made of "Neor" steel when used to cut the hard-silicon steel required for radio, motor, and power transformer laminations.

Saginaw Parkerized Ball-Bearing Casters

In order to combat corrosion and thus maintain maximum operating efficiency, the roller bearing casters manufactured by the Saginaw Stamping & Tool Company, Saginaw, Mich., are now Parkerized. A cross-sectional view of this caster is given, showing the ball-bearing construction. It will be noted that the corners of the wheel are well rounded to eliminate floor cutting, and that the stock from which it is made is particularly heavy to maintain its shape under the maximum loads for which it is offered. Casters are available in a range of sizes.

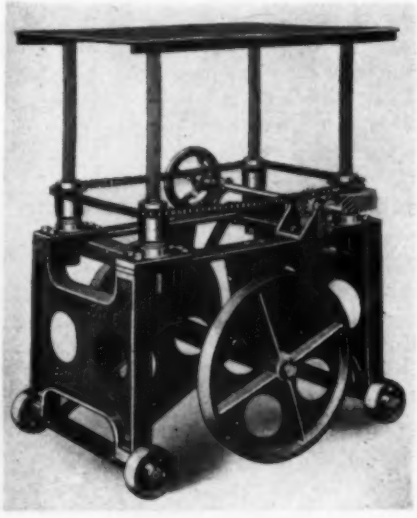


Cross-sectional view of the Saginaw Ball-Bearing Pressed-Steel Caster, which is now Parkerized

Leckie Elevating Die Truck

Heavy dies and other parts can be transported and lifted into and out of machines with the aid of the elevating truck illustrated. The truck is built in eight sizes and the lifting capacities range from 1,000 lb. to 15 tons. In the model illustrated, the table can be raised to 37 in. from the floor and lowered to 24 in. It has a solid bed 20x30 in., and can be operated by means of a hand-wheel from either side. Quick and easy operation is assured by 2 to 1 gearing.

The screws are operated by roller chains, and ball bearing thrust collars take up thrust. The center wheels are mounted on roller bearings, which facilitate movement of the truck from place to place. All members of the die truck are heavily made to withstand the service intended.



Leckie Elevating Die Truck of 1,000-lb. capacity

Capacity of the truck illustrated is 1,000 lb., and its weight is 300 lb. The largest truck manufactured has a top 48x72 in., will carry 15 tons, and weighs 2,800 pounds. The trucks have been placed on the market by David Leckie, 2231 Stewart St., Philadelphia, Pennsylvania.

Hammond Double Disk Grinders

Continuous production service may be obtained from the double disk grinders announced by the Hammond Machinery Builders, Inc., Kalamazoo, Mich. Sizes from 3 to 10 hp. are available, the disks being 12 to 24 in. in diameter. Each machine is provided with a totally inclosed motor, cooled by a fan mounted on the spindle. Clean cool air is drawn through the motor air cleaner, then through the motor windings, and discharged through the outlet in the pedestal. High overload capacity is built into the motor, which is capable of withstanding severe momentary shocks without excessive heating.

Hammond Double Disk Grinder

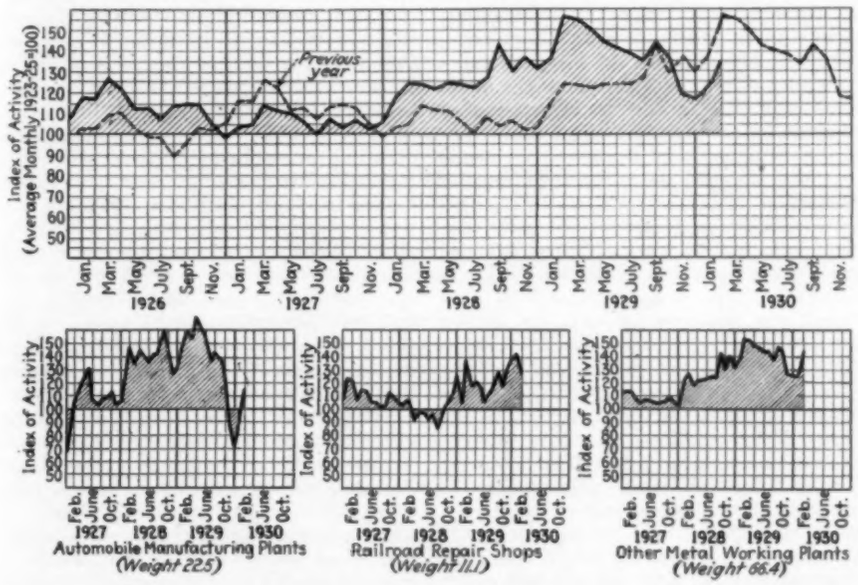
A large ground and balanced, chrome-nickel spindle is employed, and the bearings are designed to take both radial and lateral thrusts. The two disks are machined on both sides and are reversible so that two disk wheels can be mounted at the same time on each disk. After one is worn, the disk can be reversed, and thus twice the number of service hours is obtained with one operation of changing and mounting the disk wheels. Standard equipment includes one plain table and one lever feed table as shown. This machine can also be supplied with either two lever feed tables or two plain tables.

A push-button control is mounted conveniently in the front of the pedestal, and is placed in a recess to protect it from accidental starting. A Cutler-Hammer automatic motor starter is mounted on the pedestal door.

NEWS
OF THE WEEK

Metal-Working Industries Show Increases In Rate of Operations

INCOMPLETE reports on the consumption of electrical energy for power purposes indicate very clearly that an increase in the rate of operations occurred in the metal-working plants of the country during February.



A large number of manufacturing plants included in these incomplete returns indicate that the rate of operations in the plants last month was 10.8 per cent greater than that reported for January and 15.1 per cent greater than that for December, which was the low month of the present general industrial recession. The rate of operations during the current February, however, was still 11.9 per cent less than that of February of last year. The average rate of operations in these plants during the first two months of 1930 was 10.8 per cent less than that during the same period in 1929.

The automobile manufacturing industry, including the manufacture of parts and accessories, continued to increase its rate of operations during February. Last month's rate of operations in these plants was 15.1 per cent greater than that of January, and 45.0 per cent greater than that of December, the low month of the current recession. However, the present rate of operations is still 28.7 per cent less than that reported for February last year.

The February rate of operations outside the automobile plants and railroad repair shops was about 13.7 per cent greater than that of January, but was 6.3 per cent less than that of February last year.

Activity in the railroad repair shops during February was 17.1 per cent less than that in January, and 11.1 per cent less than that of February of last year.

Following are the indexes of operations in the metal-working industry as a whole, based on consumption of electrical energy and referred to the period 1923-25 as 100:

February, 1930	135.5
January, 1930	122.3
December, 1929	117.8
February, 1929	153.7

* * *

Cincinnati Metal Branch Elects 1930 Officers

Officers for 1930 were elected at the annual meeting of the Cincinnati Branch of the National Metal Trades Association on Tuesday, March 4, at the Hotel Gibson, Cincinnati. The following officers were elected for the year: President, George A. Seyler, The Lunkenheimer Co.; vice-president, H. A. Feldbush, Worthington Pump & Machinery Co.; treasurer, Perrin G. March, Jr., The Cincinnati Shaper Co.; and secretary, B. B. Quillen, The Cincinnati Planer Co. The executive committee consists of L. Scott Alter, American Tool Works Co.; T. W. Davidson, The T. J. Corcoran Lamp Co.; and Otto P. Geier, The Cincinnati Milling Machine Company.

* * *

St. Louis Chosen for Steel Founders' Meeting

St. Louis has been chosen for the next meeting of the Steel Founders' Society of America, according to an announcement at the February meeting in Philadelphia. The May meeting will be held in Cleveland on May 14, at the Hotel Hollenden.

* * *

Cost-Limiting Unit May Be Fraudulent

Occasionally, organizations of buyers or consumers to combine their purchasing power are predicated on the assumption that industry is essentially dishonest, and that manufacturers and producers commonly practice fraud and extortion in selling. Some of the proposed organizations are based on sincere idealism, but some are profit-making schemes for the benefit of incorporators or directors. Men prominent in the field of industrial purchasing are approached to lend their name and support to the organizations in return for stock allotments. Purposes and objectives of the organization are stated in such specious fashion that casual support or approval may be given by some who do not properly analyze a prospectus.

This subject came up for consideration before the Executive Committee of the National Association of Purchasing Agents at a meeting in New Orleans on Feb. 14. As a result, the following statement was issued:

"The National Association of Purchasing Agents firmly upholds the principle of legitimate competition in industry. It is opposed to combinations which seek to destroy or render inoperative this principle. It maintains that the best interests of American industry are served by adherence to the wise laws which serve to prevent harmful and illegitimate restraint of trade. It sees no difference, in principle, between a combination of sellers to control the price of a particular commodity and a combination of buyers to control the prices of various commodities. Both are wrong in principle and detrimental to industrial development."

Do Soviet Rubles Mean Dollars for the American Exporter—Politics and Unemployment—Machinery Exports Continue to Increase

By Paul Wooton
Washington Correspondent, American Machinist

WASHINGTON, D. C., March 12—A sudden revulsion is evident in the attitude of American business houses towards trading with Soviet Russia. The tide of favorable sentiment that has carried increasing quantities of American goods into the U.S.S.R. apparently is ebbing. No discouraging influence has been exercised by the administration in Washington. So far the basis of the government's policy has been that trade with Russia may help to improve rather than aggravate conditions there insofar as her relations with other countries are concerned. The thought is that every contract between American manufacturers and exporters with the Soviet tends to persuade if not to force Russia to adapt her methods to those of world trade. Her insatiable demand for long-term credits has been tempered by what accommodation she could get. That these credits now bulk large in dollar volume is a token of the meticulous execution of her contracts with exporters of machinery, tools and other supplies needed to equip Russian industry and agriculture.

As the Soviet has not defaulted on a dollar, and export sales to Russia are very profitable, the change of front by American business men may seem rather surprising. Doubt pervades the minds of those who have sold to the Soviet for ten years as well as those who are selling to Russia for the first time. The explanation appears to be that the Soviet has overplayed its propaganda, of which the so-called five-year plan is the *piece de resistance*. This is expressed in billions of rubles, thousands of tractors, hundreds of factories. The hard-boiled American business man is not scared by talk of millions but he begins to wonder where the billions are coming from and starts to investigate. His back stiffens as he probes deeper and deeper into the economic fantasies of the Soviet and his growing pessimism is the product of a more thorough understanding of actual conditions in Russia today.

The only way that Russia can make money in dollars, as distinct from rubles, which she can print, is by selling goods abroad. Her present productive capacity is limited. She can not increase it without importing and she can not increase her exports until she has increased her productive capacity.

When the Soviet asks American industry to sell goods to her on long-term credit it is asking the American business man to gamble. The risk of the whole five-year plan is shifted to him, but the execution of the plan still depends entirely upon the Soviet and any assistance that American firms may render is dependent upon conditions existing in Russia.

The American manufacturer, when he began selling machinery to Russia, demanded cash down, to show that he was unwilling to assume any of the risk of the Bolshevik experiment. The soviets came back with increased orders if he would wait for his money and he accepted the risk. So far he has collected all that was due him but he has gradually come to realize that the five-year plan is a greater gamble than even he can afford to take and he is refusing to put his money on that particular horse.

The keystone of the five-year plan, as indeed of the whole Soviet structure, is force; force used in controlling labor; force used in controlling peasants, cajoled and driven into collective farming, as opposed to individual operation. It is this new manifestation of centralized control over agriculture that has a sinister significance. It means that the physical destruction of tens of thousands of individualistic enterprises by forced collectivization in which the return to the peasant, as it has been to the worker, will be a minimum. If, as expected, more grain per acre is produced, the government will get it, not the peasant. His share in this anticipated increase in production is not fixed. If the treatment accorded to the peasant follows the line adopted in the case of the workers, whatever surplus he may achieve will be taken away in loans, taxes, or some other form of assessment. This scheme of state control of agriculture, inaugurated 18 months ago, is on all fours with the original concept that the whole country must be communized. The fanatic knows only one way of developing a country and that is by compulsion. The Soviet had to choose between capitalism and the complete destruction of capitalism and individualism along with it. Any other policy inevitably would mean the return to capitalism at some time.

The present five-year plan was inaugurated October 1, 1927. Its scope and implications were never clear until now. The more it is understood, the less it appeals to the American business man. So antagonistic and antipathetic to our individualistic creed is the iron hand emerging from the glove that the United States may tend to exaggerate its effect on Russia. The Russians may be able to endure it because they have felt its force before, but this form of government control is so far-reaching, so destructive that it does not seem that even the Russian can stomach it. Beside the extinction of individual initiative in industry and agriculture, the persecution of religion is evidence of the deprivation of every incentive and every consolation to the individual.

Where will it all end?

The present status of the five-year plan is not reassuring to those doing business with the Soviet. The program called for the appropriation of two billion rubles for investment in industry during the second year of the plan. So tremendous were the losses due to mismanagement, miscalculation and waste during the first year that it was necessary to increase the second year's appropriation to R.3,300,000,000 to absorb them. If each year it becomes necessary to add 50 per cent to the appropriations originally planned to cover the errors of the previous year there is certainly reason for doubt in the minds of American business men regarding the ultimate outcome of the five-year plan.

This week's political furore concerning unemployment has demonstrated nothing more than the need for a reliable index of employment conditions. Surprised into a defensive position by charges made in the Senate that no positive measures have been taken to find jobs for jobless men, Secretary of Labor Davis, on the administration's behalf, retorted that the delay in passage of the tariff is more responsible for creating unemployment than any other factor. Mr. Davis also remarked, rather tartly, that $50,000,000 applied to the public building program would do much more to relieve distress than if distributed in the form of a dole, as proposed by Senator Brookhart.

There is no thought of calling a national unemployment conference similar to that initiated by President Harding in 1921. Concerning Senator Wagner's proposals for establishing a national chain of unemployment clearing houses, Secretary Davis noted that the Senate has not yet passed the Labor Department's budget to extend the number of such agencies and to provide adequate statistical machinery for maintaining a current record of the number of unemployed. But he pointed out that none of these measures creates jobs right now. Secretary Davis admits that unemployment conditions are distressing but he states that the administration's program has held down employment to less than one-half that incident to previous stock market crashes.

Exports of industrial machinery continue to increase, although Walter H. Rastall, chief of the Machinery Division, Department of Commerce, comments that with call money at 12 per cent or above, one would normally expect to encounter a reduction. The January total of $23,336,000 was 14 per cent greater than in January, 1929, and represents an average of nearly $1,000,000 per working day. The major increase is in construction machinery, which was $1,000,000 up. Exports of metal-working machinery were larger by $750,000 and mining machinery by $500,000. The "all other" total increased $600,000. A decline in exports of steam engines is attributed by Mr. Rastall to the fact that they are becoming obsolete.

Management Congress and Equipment Meeting Prove Successful

TWO ventures were successfully launched in Chicago during the week of March 3—a National Management Congress and a National Industrial Equipment Exposition. An unusually large number of people were registered and probably a good many attended without going through that formality. The visitors were of high order, meetings were carried on with genuine enthusiasm, and orders were reported booked by exhibitors.

Held at the same time were the national meeting of the Materials Handling Division of the A.S.M.E. and the first Industrial Marketing Conference by the Industrial Marketing Division of the American Management Association. One of the group sessions of the congress opened this year's campaign for waste elimination in industry.

Inspection trips were made to the plants of the Western Electric Company, W. F. Hall Printing Company, Edison Electric Appliance Co., Swift & Company, Stock Yards, Inland Steel Company, Indiana Harbor, Ind., Whiting Corporation, Harvey, Ill., State Line Generating Station, Commonwealth Edison, and the Chicago Underground Tunnel.

Three papers were presented at the Plant Maintenance session: "Budgeting for Upkeep," and two papers on "Budgeting for Maintenance."

In the Materials Handling meetings, papers presented included the following: "Conveyor Handling Methods of the Chicago Daily News," "The Use of Portable Conveyors," "Shipment of Goods on Skid Platforms," "Industrial Plant Design and Operation as Affected by Transportation Between Departments," "Materials Handling in an Automotive Frame Plant," "Designing for Safety in Materials Handling," "Effect of Modern Materials Handling on Materials, Inventory, and Scrap," and "What the Materials Handling Equipment Manufacturers Need to Know."

* * *

Unusual Events Included In A.S.M.E. Plans

Two unusual events being arranged to commemorate the Fiftieth Anniversary of the American Society of Mechanical Engineers are a short play at the offices of *American Machinist* and a pageant at Stevens Institute on the first day of the celebration, April 5. The *American Machinist* play will commemorate the preliminary meeting of the organizers of the Society on February 16, 1880, in the offices of *American Machinist*, then on Fulton Street, New York. A replica of these offices will be built for the occasion, and several of the events of the original meeting and the dinner following will be presented. Luncheon will be served the delegates there immediately following the play.

Commemorating the organization meeting of the Society, held at Stevens Institute on April 7, 1880, a pageant will be held in the auditorium of Stevens Institute later in the afternoon, depicting engineering progress, as described by Dr. George Pierce Baker of Yale University and produced under his direction by the Institute. It is divided into three parts, "The Beginnings," the "Age of Steam," and the "Age of Electricity." Appropriate music will accompany the presentation throughout. The significance of the great inventions since 1880 are summed up by "Control," leading character, with the words, "I am the engineer. All of Nature's forces have been made my constant servants."

* * *

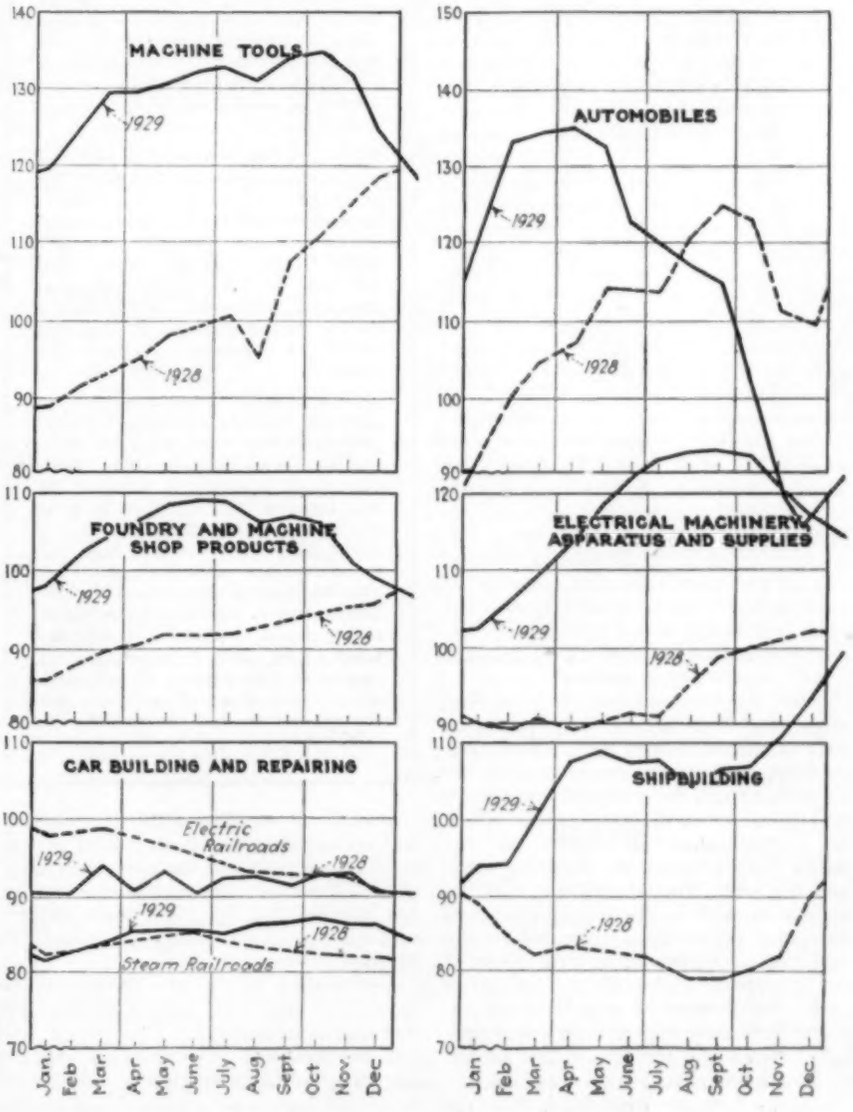
MANUFACTURERS of portable electric sawing and grinding machines and also saw blades and grinding wheels have been invited to attend a general conference in Room 301, Industrial Bldg., Bureau of Standards, Washington, D. C., on Thursday, March 20, to discuss the simplification of sizes of arbor holes for saws and wheels.

* * * *

Trend of Employment in the Metal-Working Industries

Data Supplied by the Bureau of Labor Statistics

Monthly average for 1926 = 100



BUSINESS · BAROMETER

Depression is exaggerated by politicians in their periodical race for ballots, while business itself shows improvement

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

CONGRESS consists of 96 Senators and 435 members of the House of Representatives. Of these, 32 Senators and 235 members of the House will have completed their present term of office on March 4, 1931. Therefore 267 members of the next Congress must be elected or re-elected in November, 1930.

The shadow of a political contest that is so important is already noticeable in the pivotal states. As a result the pessimists are being made aware of each other. By reiteration the depression is being exaggerated. The "outs" are blaming the party in power for the alleged unemployment, while the "ins" are denying that business is below normal or more than temporarily restrained.

The net result is that the unfavorable features of the business situation have been widely advertised, and there are many who are now insisting that we have a long period of dullness ahead of us.

This belief has been encouraged by a continued decline in commodities and by the criticism with which the Federal Farm Board has been visited by those who are opposed to governmental interference with prices. Some have gone so far as to urge the closing of the exchanges upon which grain and cotton are dealt in for future delivery. Such an extreme measure seems unlikely. If it were enacted the result would probably be the most acute depression that America has ever seen. Therefore the proposal is not to be taken seriously.

The uncertain fate of the tariff bill is another political factor that has caused more or less paralysis, and a policy of conservatism is being generally adopted which is slowing down particularly the movement of goods upon which the rate of duty is still being debated.

Under such conditions it is almost certain that the rate of distribution of goods is falling below the rate of consumption, and when confidence is restored there will be a partial vacuum in supplies which will have to be filled. The consumption of staples in the United States does not increase each year, but what the statisticians call the "secular trend" is always upward and when one year's total falls below the trend line a compensating rise above it must eventually take place. In other words, the bottom of any business recession is usually higher than every previous bottom and the top of any expansion is higher than every previous top.

Therefore, those who think that the consumption of any staple commodity will decline for more than a brief period, or that prices below the cost of production will not as usual curtail the output, are warned that they are upon perilous economic ground and that they ought to prepare to jump quickly.

Commodity prices are already down to a level that will attract buyers and increase consumption. This effect will not be apparent immediately, but the law of supply and demand is still operative, and increased consumption of the world's great staples as prices decline is as certain as it is that the day will follow the night.

Silver, sugar, rubber, silk, coffee, grain, cotton, cocoa, zinc, tin, and lead have all declined during the past week or ten days. Sugar has recently been at the lowest price on record for all time, and several other essentials are at or near the bottom since the war.

In the circumstances there would seem to be little danger in anticipating one's commercial requirements to a reasonable extent, and this is the policy which many long-headed merchants are advising. The money that is necessary to buy ahead can be borrowed at the cheapest rates in a long time, abroad as well as in this country, and it is wholly probable that evidence of large buying by those world merchants who have traditionally followed such a policy in similar circumstances will soon appear in the markets.

To hit the bottom is of course impossible, but there is not much risk in buying the staple necessities of civilized life at less than the cost of production.

There is but little change in the general business outlook. The steel mills are not so busy as they were, and some of the automobile and tire manufacturers are said to be reducing their output a little. Building is but moderately active, and upon the whole business is less satisfactory than those who were misled by the rapidity of the January recovery expected it to be. But manufacturers, and the forecasters as well, profess great confidence in the future, looking a few months ahead, and just as soon as farm products have stopped declining we ought to see a revival of hope and business activity.

England has started the ball of bank rate cuts rolling again, and other European banks are falling into line with reductions of ½ of 1 per cent. Money continues easy in this country and lower Reserve Bank rediscount rates are looked for in some quarters. Thus far the stock market has not reacted much to the decline in commodities, although it has been rather less buoyant.

The London conference is more or less in abeyance, but its failure to reach an agreement is still far from final and disappointment over its progress is premature. It still remains a potential business force of almost electric possibilities.

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From this page the reader will get a quick picture of current business and industry. The boxed material below is a summary of the letters from regional correspondents of the American Machinist, published in full on the opposite page

"JUST RIDING ALONG," the expression of a New York dealer, seems best to characterize the machinery and machine-tool market of the past week. While inquiries continue in unabated volume, hesitancy in placing signatures on the dotted line still persists. A desultory volume of single orders for replacement tools with indications of good business just ahead, is the verdict of most dealers and manufacturers.

NEW YORK business is still for single items, with the D.L.&W. list expected to close this week. Detroit dealers report little change, but a tendency towards improvement. New England orders are for one or two tools, railroads appearing interested. Philadelphia dealers report a slight decline, but expect a recovery within two weeks.

MILWAUKEE production schedules are holding up well, no cancellations are reported, and substantial sales are in the offing. Cleveland business is working its way upward, with inquiries as good as ever. Cincinnati reports a slight gain for the week, both for manufacturers and dealers. Chicago business is considered slightly better, and is expected to continue to improve. Buffalo conditions seem to be quite definitely on the upgrade. Expressions of optimism are common from all quarters, and the general tone of business in the metal trades is considerably better.

THE INDUSTRIAL REVIEW

Weekly progress of the machinery and machine-tool business

THE following reports, gathered from the various machinery and machine-tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

NEW YORK

Machinery and machine-tool dealers in the New York district are "just riding along," according to their statements. February sales totals were about as expected, and March totals will probably be greater in many cases as a result of the increasing number of inquiries for immediate closure. The only large list out at the present time is the D L & W, which is expected to be closed sometime during the present week.

Several dealers report a slight falling off for the week just closed, a condition which is entirely normal in the first week of any month. Prospects for closings during the present week are good. The market condition reflects shop conditions, some being extremely active, some extremely slow. One dealer reports the closing of a good-sized order which has been hanging fire since last October, and the indication that several other ones quoted on at about the same time will be closed soon. Another dealer expects March to equal February in point of sales, and claims that if it does, he will be "tickled to death." Expressions are generally optimistic, and business is considered better structurally from week to week. Deliveries are good on most tools.

DETROIT

Conditions in the machinery and machine-tool trade have undergone slight change within the past few weeks. Some improvement was felt in the early part of February and business has been generally much better than it was in January and December. A few good-sized orders were received, and there are many indications that these will be followed by larger ones this month and next.

In general, automobile manufacturers are not buying as much equipment as the dealers here believed they would early this year but some dealers have reported an unusual increase in business since that time. Inquiries are increasing in number and are also more encouraging in other ways. There is a good feeling throughout the automobile business in spite of a few setbacks suffered by individual manufacturers. A few plants have curtailed production sharply or have shutdown, but this is not considered significant.

The contract jobbing shops are still running with reduced payrolls and are buying little or nothing. The general tone of business throughout Detroit and Michigan seems to be improving.

NEW ENGLAND

The feature of the New England machine-tool market is still confined to inquiries, which are numerous enough to be most encouraging. Orders, however, are not equally encouraging, and are generally for one or two tools. This ambiguous condition, in evidence more or less since the year began, is directly traceable to a widespread conservatism in many lines of manufacturing, resulting in restricted machine-tool buying. Present buying carries the stamp of immediate requirement, which in view of the constant high level of buying in 1929, cannot be representative of a high level of business now.

The week's business was on a par with recent weeks, and devoid of outstanding features. A number of automobile body builders in this section received substantial orders during the week representing several month's activity at full schedules. This trend further exemplifies the contention that the automobile industry is gradually resuming an activity that should result in machinery orders. Small parts shops are also more active.

The week seemed to show a better tone to demand for lathes and drill, while grinding equipment is selling at a better than seasonal level. At least three railroads were represented among inquiries for New England tools. Small tool buying is fairly active.

PHILADELPHIA

Although the machinery and machine-tool business has been in a decline throughout the Philadelphia area during the last two weeks, many of the leaders of the industry look forward to a recovery in a short time. There has been a dearth of orders on all kinds of machinery and allied materials, many of the producers and agents reporting that business is at 50 per cent of what it was at this time last year, sales in other lines being off about 18 per cent.

The brightest spot in the industry in this market during the last two weeks was the statement from the Baldwin Locomotive Works that the company has $24,000,000 worth of unfilled orders on its books. Operations in the second quarter of the year will be normal, the officials reported.

MILWAUKEE

Despite the fact that current bookings continue to run light and uneven, production schedules in most machine-tool plants are holding up very well, and the feeling grows stronger that before present orders are worked down new business will develop in a fully compensating way. It is considered significant that inquiry is expanding measureably and while action on quotations is not so prompt as in more nearly normal periods, there is every reason to believe that a substantial volume of actual purchases is in the offing.

The contraction of production in general since late last fall has not been accompanied by the wholesale cancellation of orders that ordinarily occurs. Orders were placed last September and October for tools required five to seven months hence and there has been little hesitancy about accepting delivery according to specifications.

CLEVELAND

Cleveland machine-tool business is slowly but gradually working its way upward. A few expressions are made of a "spotty" condition, but as a whole, the trade reports increases in sales during February, as compared with January, with larger increases as compared with December, 1929. While dealers report "spotty" business, producers sales charts show more definite assurance of better business. Chief among these is increased business reported by punch press and automatic tool manufacturers, which are enjoying above-average business. Machine shops, punch and die concerns, structural steel fabricators, and steel-tube manufacturers are buying at the present time. A Youngstown steel tube concern has a list out for fifteen tools.

Inquiries are as plentiful as they were a month ago. A prominent dealer has quotations out for approximately $150,000 worth of tools.

CINCINNATI

A slight gain was made in the past week by about one-half of the machine-tool manufacturers of the Cincinnati district, the remainder reporting demand about the same as in the previous week. All report a good volume of business pending, the only thing standing in the way of increased volume being the continued tendency of users to postpone commitments.

The backbone of the market was a well-scattered and well-diversified demand for single tools and replacements, from general machinists and miscellaneous users. No important sales are reported.

Manufacturers received a good volume of inquiries, coming from all sections of the country, and well diversified as to sizes and types of tools required. The major portion of these were for single items and came from small users, but here and there was an inquiry for two or three pieces of equipment. Several small lists were submitted by railroads, and an inquiry for lathes came from the U. S. Navy.

Selling agents report the demand increasing gradually in local and adjacent territory. The past week's sales were at a fairly good level.

CHICAGO

A slight improvement in the machine-tool market for the first week in March is reported by a few manufacturers' representatives and dealers. In the main, however, conditions have shown little change thus far in the month. Industrial demand still lags, and those who had hoped to close on a number of prospective sales have reached the conclusion that not until this month is well advanced will there be shown a disposition to buy on the part of several industrialists who have indicated by inquiries their needs for new shop equipment. Two or three sales of importance, consisting of heavy-duty units, are reported by the local branch of one of the leading makers of machine-tools, but apart from this no buying of moment is mentioned. Such railroads as have had lists before the trade have closed on the major part of their requirements, although there still remain a number of items outstanding. The International Harvester Co. has submitted inquiries for shop equipment additional to those previously noted, as has also the Allis Chalmers Co. of Milwaukee, the tools when bought to go to the tractor plants of these companies. Demand for used tools is slowing up.

BUFFALO

Highly varied are the reports which are given currently among machine-tool dealers in the Buffalo district. General business conditions seem to be quite definitely on the upgrade, but some dealers have not yet noticed it or had any material benefit from it.

However, the fact that some of the dealers seem to be doing a little more business than they did two weeks ago may be taken as a favorable sign. The feeling is that the next quarter will show a marked improvement—that some worth while business really will develop before early summer.

Business Items

The Wickwire-Spencer Steel Corporation, Worcester, Mass., has abandoned its ornamental wire department. This plant was recently located at Clinton, Mass., where it was moved from Worcester. The Wickwire company recently sold its wire goods department to the Washburn Co., also of Worcester.

The Theurer Wagon Works, Inc., now located at 10th Ave. and 56th St., New York, has purchased the plant of J. A. Migel, Inc., located between Traphagen and Charles Sts., in North Bergen, N. J. The plant is a four-story basement structure of brick, steel, and concrete, with daylight construction, embracing 100,000 sq.ft. of floor space.

The Equitable Securities Corporation, Montreal and Toronto, has acquired the James Morrison Brass Manufacturing Co., Ltd., Toronto. The new name of the company is the Morrison Brass Manufacturing Co., Ltd., and associated with the Equitable Securities Corporation.

Consolidation of the Eaton Axle & Spring Co. and the Wilcox-Rich Corporation, Cleveland and Detroit, respectively, has been approved by the board of directors of the two companies, according to an announcement by J. O. Eaton, chairman of the board of Eaton Axle, and Carlton M. Higbie, chairman of the board of Wilcox-Rich. Simultaneously, Eaton Axle announced the acquisition of another Detroit concern, the Peterson Spring Company.

The Duckworth Chain & Manufacturing Co., Springfield, Mass., will be merged with the Baldwin Chain & Manufacturing Co., Worcester, Mass., and organized under both names as a $2,000,000 concern. George P. Empsall of the Duckworth company will head the new company and Frank J. Weschler, for many years connected with the Indian Motocycle Company, will be vice-president and treasurer. Both companies will continue to function as separate units.

The Gilbert & Barker Manufacturing Co. of Canada, Ltd., has been formed as a subsidiary of the Gilbert & Barker Manufacturing Co., West Springfield, Mass. The new concern, with plant in Toronto, will produce for the Canadian trade in Gilbert & Barker products. Principal officers, headed by Charles C. Ramsdell as president, are the same as the officers of the parent company.

Manning, Maxwell & Moore, Inc., announce the appointment of Smith Booth Usher Co., 228 Central Ave., Los Angeles, Calif., as representative for Southern California to cover the sale of Putnam Machine Tools, manufactured at the Putnam Machine Works, Fitchburg, Massachusetts.

The Ruth Dredger Manufacturing Corporation, Ltd., has been formed to succeed the Ruth Dredger Manufacturing Co., Los Angeles, Calif. Frank W. Clark is president, and W. B. Merriam, who has been associated with the Ruth company for a number of years, will continue in an executive capacity.

The Charles A. Strelinger Co., 149 East Larned St., Detroit, Mich., will handle the sales and service of the threading dies, collapsing taps, and similar production threading tools of the National Acme Co., Cleveland. The Strelinger Company will carry a complete stock in Detroit.

The Melrose Steel Co., Oakland, Calif. has leased a factory containing 5,000 sq.ft. of floor space and will engage in structural steel fabrication, specializing in service station work. R. Coney, William Jaeger, and E. Balwick are co-partners in the enterprise.

The Great Lakes Steel Corporation, a unit of the National Steel Corporation, has completed the stripper house at its new plant at Detroit. This is the first unit of the new $20,000,000 mill to be finished. Final completion of the entire plant is scheduled for late summer.

The Southern Electric Works, Inc., is an industrial and motor contracting firm recently established at 1167 East Sixty-Third St., Los Angeles. Robert J. Hanchett is president of the company. E. B. Morgan is secretary and Thomas V. Cassidy is vice-president.

B. F. Perkins & Son, Inc., Holyoke, Mass., has taken over the business of the Vacuum Valve Cap Co., Springfield, Mass. Alexander Campbell, president and treasurer of the Vacuum Valve Cap Co., has joined the Perkins company and will have charge of manufacturing.

The R. W. Cornwall Manufacturing Co. has merged with the Steel Blanking Co., Sandusky, Ohio, and is now to be known as the Steel Blanking Co., with address at 504 E. Market St., Sandusky.

The Swartwout Co., 18511 Euclid Ave., Cleveland, Ohio, has taken over the entire business of the S-C Regulator Manufacturing Co., Fostoria, Ohio, and is now manufacturing all S-C products in its own plant.

The Goddard & Goddard Co., Inc., is now located at 12280 Burt Road, Detroit.

The Dumore Co. has moved its office to Room 612, the Park-Murray Bldg., New York City.

Personals

GEO. T. AITKEN has been appointed general sales manager of the National Acme Co., Cleveland.

E. M. ANDERSON, assistant purchasing agent for many years at the Batavia, N. Y., plant of the Massey-Harris Co., Racine, Wis., has been promoted to purchasing agent to succeed GUY E. LOWN, resigned.

J. ERNEST ANDREW has been elected president of the Wallace Barnes Co., Bristol, Conn. He succeeds FULLER F. BARNES, who becomes chairman of the board of directors. DWIGHT C. BUFFUM, formerly assistant treasurer, becomes a vice-president.

PROF. JOSEPH W. BARKER, head of the department of electrical engineering, Lehigh University, was appointed to succeed Dean George E. Pram as dean of the faculty of engineering of Columbia University, according to a recent announcement by Pres. Nicholas Murray Butler following a monthly meeting of the university trustees.

W. E. CHOLLAR has been appointed vice-president and general manager of the Remington Cash Register Co., Ilion, N. Y., subsidiary of Remington Arms Co., Inc., New York, to succeed PAUL V. BUNN, resigned. Mr. Chollar has been general purchasing agent for several years and was recently appointed vice-president of the Remington Arms Co. He has been associated with the organization for 14 years.

WILLIAM T. COSTELLO, New Britain, Conn., and WILLIAM J. VICTORY, Hartford, Conn., who have been employed by the New Britain Machine Co., New Britain, for many years, were recently elected vice-presidents.

WILLIAM H. EAGER was re-elected president of Whitman & Barnes, Inc., and its subsidiary, Canadian Detroit Twist Drill Co., Ltd., at the recent stockholders' meeting. Other officers elected were: KARL KENDIG, vice-president and treasurer; J. I. HOLTON, secretary; N. J. SMITH, asst. secretary. Directors: W. H. EAGER, A. D. ARMITAGE, J. G. HAMBLEN, JR., C. H. HECKER, KARL KENDIG, C. BLAKE McDOWELL, W. J. O'NEILL, H. H. SANGER. Other officers of the Canadian Detroit Twist Drill Co., Ltd., are: E. L. Foreman, vice-president; Karl Kendig, secretary and treasurer; R. G. Matley, general manager. Directors: W. H. Eager, E. L. Foreman, C. H. Hecker, Karl Kendig, M. B. Snow.

FRANK W. FABER, secretary-treasurer of the Galion (Ohio) Iron Works & Manufacturing Co., has resigned. He was one of the original stockholders and will retain his stock holdings.

J. W. FORGIE, for many years general factory superintendent of the National Gauge & Equipment Co., LaCrosse, Wis., has been appointed general superintendent of the Van Sicklen Corporation, associate company of Allied Motor Industries, Incorporated.

R. T. GILLETTE, engineer in charge of resistance welding development in the Schenectady plant of the General Electric Co., spoke on "Resistance Welding" at the March 11th meeting of the Metropolitan Section, American Welding Society.

WILLIAM J. HOBBS, vice-president of the Boston & Maine Railroad Co., Boston, Mass., has resigned after 57 years of service. Mr. Hobbs is 76 years old and will be succeeded as vice-president by WILLIAM S. TROWBRIDGE, who is advanced from comptroller.

W. L. MACRAE, 728 State Tower Bldg., Syracuse, N. Y., has been ap-

pointed Western New York representative of Baker Brothers, Inc., Toledo, Ohio, his territory including Syracuse, Rochester, and Buffalo. Mr. MacRae also represents the Keller Mechanical Engraver Co., and the Oilgear Co. in that territory.

GEORGE H. HOUSTON, president of the Baldwin Locomotive Works, has been elected to the directorate of the Flannery Bolt Co., Pittsburgh.

LIEUT.-COL. SIR JAMES LITHGOW was recently nominated present-elect of the Federation of British Industries, London, England, to succeed LENNOX B. LEE, president during the past year.

E. R. NORRIS has been appointed assistant to the vice-president, according to an announcement issued by J. S. Tritle, vice-president in charge of manufacturing of the Westinghouse Electric

& Manufacturing Co. Mr. Norris, formerly general works manager, will now be responsible for all plant facilities, manufacturing methods, cost reduction, and inspection. He has been associated with the Westinghouse Company since 1892.

C. R. MESSINGER was elected chairman of the board of the Sivyer Steel Casting Co., Milwaukeee, at a recent stockholders' meeting following consolidation with the Nugent Steel Castings Co. of Chicago. L. S. PEREGOY was elected president and M. A. FLADOES, vice-president in charge of sales. GEORGE L. POLLOCK is secretary and C. A. MACDONALD is treasurer. Directors are: C. R. MESSINGER, W. C. FRYE, WALTER KASTEN, DONALD FRASER, C. F. MESSINGER, E. L. WOOD, L. S. PEREGOY, C. A. MACDONALD, M. A. FLADOES and C. E. STONE.

GEORGE V. MYRMIRIAN arrived on Feb. 27 on the S.S. *Ile de France* to visit American metal-working tool manufacturers and to secure their sales representation in France. His address while here is 200 Broadway, New York City, c/o Errington Mechanical Laboratory.

W. E. ODOM, director of industrial relations for the National Metal Trades Association, spoke at the annual dinner of the Fox Valley Manufacturers' Association in the Elks club, Aurora, Ill., the night of Feb. 17. His topic was "The Older Worker in Industry." Officers of the association who serve this year are H. H. BARBER, president; H. G. CHAPMAN, vice-president; C. A. KRAUSE, treasurer; and J. W. HUNT, past president.

J. W. OTTO has been elected president of the Wisconsin Machinery & Manufacturing Co., Milwaukee, Wis., to succeed the late Wm. H. Vogel. O. W. BROWN has been elected vice-president and L. E. VOGEL has been re-elected secretary and treasurer.

H. HOBART PORTER has been re-elected chairman of the Engineering Foundation Research Organization of the National Society of Civil, Mining and Metallurgical, Mechanical, and Electrical Engineers. Mr. Porter is president of the American Water Works & Electric Co., and of several other companies. OTIS V. HOVEY and G. N. CLEVENGER were elected vice-chairmen of the foundation. GANO DUNN and GEORGE L. KNIGHT were named additional members of the executive committee. ALFRED D. FLYNN was re-elected director and secretary.

STANLEY P. ROCKWELL, president of the S. P. Rockwell Co., Hartford, Conn., was the speaker at the March meeting of the Hartford Chapter, A.S.S.T. His talk followed the visitation and meeting of the Hartford Chapter at the new heat-treating plant of the Rockwell Company.

M. C. STEFFEN, who for five years has been in the St. Louis office of Cutler-Hammer, Inc., Milwaukee, has been made manager of the company's Cincinnati office to succeed R. I. MAUJER, resigned.

J. E. WEBSTER, Los Angeles, was re-elected chairman of the California Iron, Steel & Allied Industries Conference, Feb. 15. The next conference will be held at Del Monte, Calif., from Feb. 12 to 14, 1931.

THOMAS C. WRIGHT, formerly Philadelphia district representative of the New Departure Co., Bristol, Conn., has become affiliated with the Worcester Pressed Steel Co., Worcester, Mass., in charge of cold-rolled strip steel sales, to succeed FRANK C. SMITH.

A. M. YORK has been appointed Chicago representative of the Black & Decker Manufacturing Co., Towson, Md., succeeding C. M. Hall. Mr. York for some years has been active in the sales department of the company in the Chicago office.

Obituaries

JOHN J. AMORY, Morris Heights, N. Y., president of the Consolidated Shipbuilding Corporation, and chairman of the recent Jubilee Motor Boat Show in New York, died on Feb. 26 in New York City. He was 73 years of age and a member of the Society of Naval Architects & Marine Engineers and the Society of Automotive Engineers.

ISAAC S. HOLBROOK, manager of advertising for *Engineering News-Record* and *Construction Methods*, died on March 7 in Miami, Fla., where he had gone to recuperate from illness.

Forthcoming Meetings

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Fiftieth Anniversary celebration. Opens in New York, April 5, afternoon in Hoboken; April 6 in New York; April 7, 8, and 9 in Washington, D. C., at the Mayflower Hotel. Calvin W. Rice, 29 West 39th St., New York City, secretary.

AMERICAN WELDING SOCIETY—Annual meeting at Society headquarters, New York City, April 22-25. M. M. Kelly, 33 West 39th St., New York, is secretary.

NATIONAL POWER SHOW — Held in connection with the International Textile Exposition, Mechanics Bldg., Boston, Mass., April 28 to May 3. For information write to New England Association of Commercial Engineers, 53 Devonshire Road, Boston.

AMERICAN FOUNDRYMEN'S ASSOCIATION — Annual Convention, Cleveland Public Auditorium, Cleveland, Ohio, May 12-17. C. E. Hoyt, 222 W. Adams St., Chicago, is secretary-treasurer.

SOCIETY OF AUTOMOTIVE ENGINEERS —1930 Summer Meeting, French Lick Springs Hotel, French Lick Springs, Ind., May 25-29. National headquarters are at the Engineering Societies Bldg., 29 W. 39th St., New York City.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS — Semi-annual meeting, Hotel Book-Cadillac, Detroit, June 2 to 12. Calvin W. Rice, 29 West 39th St., New York City, is secretary.

NATIONAL ASSOCIATION OF FOREMEN —Convention at Toledo, Ohio, June 6-7. Harry J. Baumker, 316 Tenth St., Toledo, is convention secretary.

STEEL INDUSTRY'S EXECUTIVES—Annual Iron & Steel Exposition. Under the sponsorship of the Iron & Steel Electrical Engineers, June 16-20, Broadway Auditorium, Buffalo, N. Y. John F. Kelly, 1010 Empire Bldg., Pittsburgh, Pa., is managing director.

AMERICAN SOCIETY FOR TESTING MATERIALS—Annual meeting, Haddon Hall, Atlantic City, N. J. June 23-27. C. L. Warwick, 1315 Spruce Street, Philadelphia, is secretary-treasurer.

STEEL FOUNDERS' SOCIETY OF AMERICA—Semi-annual convention, Greenbrier Hotel, White Sulphur Springs, Va., June 26-27. G. P. Rogers, 932 Graybar Bldg., New York City, is managing director.

INTERNATIONAL CONGRESS FOR GENERAL MECHANICS — Liege, Belgium, Aug. 31 to Sept. 7. For information address Alb. Schlag, 4 Place Saint Lumbert, Liege, Belgium.

THE WEEKLY PRICE GUIDE . . .

Rise and Fall of the Market

IRON prices are weakening. Meanwhile, there is recession in demand for automotive and railway steel as well as fabricated structurals. Prices of shop materials fluctuated widely during the last week. Steel sheets are higher at Pittsburgh, while hoops and bands declined in Chicago. Antimony rose in New York and Cleveland, scrap crucible copper, in New York, while tin declined at New York and lead and zinc, in East St. Louis. Cutting oil is up and linseed oil, down at New York.

(All prices as of Mar. 7, 1930)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b:

CINCINNATI	
No. 2 Southern (silicon 1.75@2.25)	$17.69@$18.19
Northern Basic	19.90
Southern Ohio No. 2	19.90
NEW YORK—Tidewater Delivery	
No. 2 Southern (silicon 1.75@2.25)	19.50
BIRMINGHAM	
No. 2 Foundry (silicon 1.75@2.25)	15.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	21.76@22.26
Virginia No. 2	24.04
Basic	19.75@20.25
CHICAGO	
No. 2 Foundry, local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 1.75@2.25)	20.01
PITTSBURGH, including freight charge ($1.76) from Valley:	
No. 2 Foundry	20.26
Basic	20.26
Bessemer	20.76

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb:

Detroit	4.50
Cleveland	5.00
Cincinnati	4.50
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots:

Blue Annealed*	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.10	3.35†	3.30	3.90†
No. 12	2.15	3.45†	3.35	3.95†
No. 14	2.25	3.55†	3.45	4.00†
No. 16	2.35	3.65†	3.55	4.10†
Black				
Nos. 18 to 20	2.45@2.55	3.85†	3.55	3.70
No. 22	2.60@2.70	4.00†	3.70	3.85
No. 24	2.65@2.75	4.05†	3.75	3.90
No. 26	2.75@2.85	4.15†	3.85	4.00
No. 28	2.90@3.00	4.75†	4.00	4.15
Galvanized				
No. 10	2.60@2.70	3.90†	3.80	3.80
Nos. 12 to 14	2.70@2.80	4.00†	3.90	3.90
No. 16	2.80@2.90	4.10†	4.00	4.00
No. 18	2.95@3.05	4.25†	4.15	4.15
No. 20	3.10@3.20	4.40†	4.30	4.30
No. 22	3.15@3.25	4.45†	4.35	4.35*
No. 24	3.30@3.40	4.60†	4.50	4.50
No. 26	3.55@3.65	4.85†	4.75	4.75
No. 28	3.80@3.90	5.10†	5.00	5.00

*Light plates. †Up to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. butt	53.74%	41.2%	55.5%	43.5%	55.5%	42.5%
3½ to 6 in. lap	50.32%	37.78%	53.5%	40.5%	51.6%	39.0%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	Diameter in Inches—External	Diameter in Inches—Internal	Thickness Inches
⅛	$0.17	1.315	1.049	.133
¼	.23	1.66	1.38	.14
⅜	.27½	1.9	1.61	.145
½	.37	2.375	2.067	.154
⅝	.58½	2.875	2.469	.203
¾	.76½	3.5	3.068	.216
⅞	.92	4.0	3.548	.226
1	1.09	4.5	4.026	.237
1¼	1.48	5.563	5.047	.258
1½	1.92	6.625	6.065	.28
2	2.50	8.625	8.071	.277

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb:

Thickness—Decimal Fractions	B.w.g. and	Outside Diameter in Inches—Price per Foot— ½	⅝	¾	⅞	1	1¼	1½
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.25†	4.00	3.75†
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10†	5.30	5.00†
Cold drawn, round or hexagon‡	3.40	3.65	3.60
Cold drawn, flat or square‡	3.90	4.15	4.10
Structural shapes	3.30†	3.00	3.10†
Soft steel bars	3.25†	3.00	3.00†
Soft steel bar shapes	3.25†	3.00	3.00†
Soft steel bands	3.75†	3.65	3.20†
Tank plates	3.30†	3.00	3.10†
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, $\frac{3}{16}$-in. thick by ¼-in. wide. †Up to 3,999 lb., ordered and released for shipment at one time. ‡Cold finished steel, shafting and screw stock.

Electric welding wire at New York warehouse— $\frac{3}{32}$, 8.35c. per lb.; ⅛, 7.85c. per lb.; $\frac{5}{32}$ to ¼, 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:

Copper, electrolytic, New York			19.25
Tin, Straits, pigs, New York			40.00@41.00
Lead, pigs, E. St. Louis	5.85	New York	7.00@7.50
Zinc, slabs, E. St. Louis	5.07½	New York	6.50@7.50

	New York	Cleveland	Chicago
Antimony, slabs	11.00@11.50	11.87½	14.50
Copper sheets, base	27.75	27.75	27.75
Copper wire, base	20.12½	20.12½	20.12½
Copper, drawn, round, base	26.25	26.25	26.25
Copper tubing, base	29.25	29.25	29.25
Brass sheets, high, base	23.25	23.25	23.25
Brass tubing, high, base	28.25	28.25	28.25
Brass rods, high, base	21.25	21.25	21.25
Brass wire, high, base	23.75	23.75	23.75

SHOP MATERIALS AND SUPPLIES

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%.....	25@26	24.30	24.30
Zinc sheets (casks).....	10.75@11.25	12.25	10.11
Solder (½ and ½).....	29.25	29.75	28@30
Babbitt metal, delivered in case lots, New York, cents per lb:			
Genuine, highest grade.....			57.00
Commercial genuine, intermediate grade.....			42.00
Anti-friction metal, general service.....			31.00
No. 4 babbitt, f.o.b.....			11.50

NICKEL AND MONEL METAL—Price in cents per lb., base, f.o.b. Huntington, W. Va:

	Nickel	Monel Metal
Sheets, full finished.....	52.00	42.00
Sheets, cold rolled.....	60.00	50.00
Strip, cold rolled.....	55.00	45.00
Rods, hot rolled.....	45.00	35.00
Rods, cold drawn.....	53.00	40.00
Tubing.....	75.00*	90.00†
Angles, hot rolled.....	50.00	40.00
Plates.....	52.00	42.00

*Seamless. †Welded.

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars:

	New York	Cleveland	Chicago
Crucible copper.....	14.75 @15.25	13.50	13.00 @13.50
Copper, heavy, and wire..	13.50 @14.00	13.00	12.25 @12.75
Copper, light, and bottoms	12.00 @12.25	12.00	11.25 @11.75
Heavy lead.....	4.50 @ 5.00	5.25	4.25 @ 4.75
Tea lead.....	2.87½@ 3.12½	3.25	3.25 @ 3.75
Brass, heavy, yellow.....	7.75 @ 8.00	8.00	7.25 @ 7.75
Brass, heavy, red.....	11.25 @11.75	12.50	10.25 @10.75
Brass, light.....	6.25 @ 6.75	7.00	6.25 @ 6.75
No. 1 rod-brass turnings.	9.00 @ 9.25	8.00	7.75 @ 8.25
Zinc.....	2.50 @ 2.75	3.00	2.00 @ 2.50

TIN PLATES—Charcoal—Bright—Per box:

	New York	Cleveland	Chicago
"AAA" Grade:			
IC, 14x20.....	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20.....	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20.....	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20.....	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb..	$0.13*	$0.16	$0.15
Cotton waste, colored, per lb..	.09½*	.12	.12
Wiping cloths, washed, white, per lb.....	.12½	38.00 per M	.16
Sal soda, per lb.....	.02½	.02	.02
Roll sulphur, per lb.....	.028	.03½	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.....	.145	.164	154
Cutting oil, about 25% lard, in 5 gal. cans, per gal.....	.75	.60	.65
Machine oil, medium-bodied (55 gal. steel bbl.) per gal..	.33	.36	.24
Belting — Present discounts from list in fair quantities (½ doz. rolls) for leather or rubber:			
Leather—List price, 24c. per lin. ft., per inch of width, for single ply:			
Medium grade.....	30–10%	30–10%	35%
Med. grade, heavy wgt..	30%	30– 5%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft:			
First grade.....	50%	50–10%	50%
Second grade.....	60%	60– 5%	50–10%

*Grade F.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars.....	per lb..	$0.0325	$0.0325	$0.0325
Cold drawn shafting...	per lb..	.034	.035	.035
Brass rods.....	per lb..	.2125	.2125	.205
Solder (½ and ½).....	per lb..	.2925	.2975	.3475
Cotton waste, white...	per lb..	.13	.13	.10@.13½
Disks, aluminum oxide mineral, cloth, No. 1, 6-in. dia.....	per 100.	4.59	4.59	3.59
Lard cutting oil.....	per gal.	.75	.65	.55
Machine oil.....	per gal.	.33	.33	.33
Belting, leather, medium.....	off list..	30–10%	30–10%	30–10%
Machine bolts, up to 1x30 in., full kegs...	off list..	50-10%*	50–10%*	50–10%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper*.....	$6.03	$6.03	$6.03
Emery cloth*.....	25.87	25.87	25.87
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper†.....	2.61	2.61	2.61
Cloth†.....	4.59	4.59	4.59
Fire clay, per 100 lb. bag.....	1.00	.75	.75
Coke, prompt furnace, per net ton.....	Connellsville,		2.60
Coke, prompt foundry, per net ton.....	Connellsville,		3.50@4.85
White lead, dry.....	100 lb. kegs ...	New York,	13.75
White lead, in oil.....	100 lb. kegs....	New York,	14.25
Red lead, dry.....	100 lb. kegs....	New York,	13.75
Red lead, in oil.....	100 lb. kegs....	New York,	15.25

*Less than 3 reams. †Less than 200

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

Machine bolts:	
Up to ¾-in. x 6-in., full kegs, list less.....	60%
Larger, up to 1 x 30-in., full kegs, list less.....	50–10%
Less than full kegs or case lots, add to list.....	10%
Fitting-up bolts: list less.....	45%
Lag screws:	
Up to ½-in. x 6-in., list less.....	60%
Larger, list less.....	50–10%
Less than full keg or case lots, add to list.....	10%
Rivets:	
Structural, round head, full kegs, net.....	$4.50
Structural, round head, broken kegs, net.....	6.00
Tank, 7/8-in. dia. and smaller, list less.....	60%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped:	
Full kegs up to 1-in., incl., list less.....	60%
Larger, up to 3-in., list less.....	40–10%
Less than keg or case lots, add to list.....	10%
Washers:	
Wrought, full kegs, per 100 lb., list less.....	$4.00
Wrought, broken kegs, per 100 lb., list less.....	2.00
Turnbuckles:	
With stub ends, list less.....	20%
Without stub ends, list less.....	50%
Chain:	
Proof coil, base, per 100 lb., net.....	$8.50
Cast iron welding flux, per lb., net.....	35
Brazing flux, per lb., net.....	.50

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Equipment Wanted

Mich., Detroit — Colonial Replacement Parts Co., 6834 Michigan Ave. (machine and auto repair work)—piston grinder, body sanding machine, paint spray, and key seating machine.

Mich., Detroit — Motor Specialties Co., Mt. Elliott Ave. (automobile accessories)—machine shop equipment.

Minn., St. Paul — Dept. of Public Works, K. L. Fieseler, Purch. Agt. will receive bids until Mar. 18, for one 7½ ton crane at Workshop, Dale and Burgess Sts.

Opportunities for Future Business

Ark., North Little Rock (Br. of Little Rock)—Whitney Harb Ford Motor Co., 115-17 East Third St., awarded contract for the construction of a 2 story sales and service station on West Third St., here. Estimated cost $100,000.

Calif., Los Angeles—Gillespie Furniture Co., c/o Austin Co. of California, 777 East Washington St., awarded contract for a 1 story, 150 x 450 ft. factory on East Pico St. Estimated cost $150,000.

Calif., Los Angeles—Pacific Iron & Steel Co., 241 West Ave., 26, is having plans prepared for the construction of a manufacturing plant at Alameda Blvd. Estimated to exceed $40,000. Private plans.

Calif., Oakland — American Creamery Co., 1433 Cypress Ave., plans to remodel plant for machine shop at Cypress Ave. near 14th St. in connection with proposed creamery at 14th and Poplar Sts. Estimated cost $200,000. Private plans. Work will be done by day labor.

Calif., San Francisco—Folsom Street Iron Works, 17th and Missouri Sts., awarded contract for the construction of a 1 story ornamental and plain iron works plant at 17th and Connecticut Sts. Estimated cost $40,000.

Calif., Wilmington—Welded Steel Shipbuilders Ltd. plans the construction of a ship building plant.

Conn., Elmwood — New Departure Mfg. Co. awarded contract for additions and alterations to four factory units. Estimated cost to exceed $40,000.

Conn., New Britain—Southern New England Telephone Co., 357 Church St., New Haven, awarded contract for a 1 story, 55 x 125 ft. service building and work shop at Pearl and Franklin Sq. Estimated cost $50,000.

D. C., Washington—Bureau of Yards & Docks, Navy Dept., plans addition to boilermakers shop building at Navy Yard.

Ill., Rockford—Woodward Governor Co., W. T. Woodward, Secy. and Treas., is having preliminary plans prepared for a 2 story 70 x 160 ft. addition to engine governor plant on Mills St. Estimated cost $60,000. F. A. Carpenter, Brown Bldg., Archt.

Mass., Cambridge—General Radio Co., 30 State St., will soon award contract for the construction of a 4 story, 50 x 100 and 20 x 23 ft. addition to factory. Estimated cost $90,000. Lockwood Greene Engrs. Inc., 24 Federal St., Boston, Engrs. Noted Mar. 6.

Mass., Lowell—J. Blackstock, 31 Morton St., will build a 1 story garage and repair shop at 576 Rogers St. Estimated cost $40,000. Work will be done by separate contracts. Noted Mar. 6.

Mass., New Bedford—National Service Building Trust., c/o W. A. Dykeman, 10 Devonshire St., Boston, Archt., awarded contract for a 1 and 2 story, 80 x 240 ft. garage and repair shop at South Water and Walnut Sts. Estimated cost $50,000. Noted Feb. 13.

Mass., Watertown—Arden Box Toe Co., Calvin Rd., East Watertown, awarded contract for a 2 story addition to factory. Estimated cost $45,000.

Mich., Detroit — Bohn Aluminum & Brass Corp., 2512 East Grand Blvd., is having plans prepared for the construction of a 1 and 4 story factory for the manufacture of automobile parts and other aluminum products. Estimated cost $1,000,000. C. W. Brandt, 1016-18 Francis Palms Bldg., Archt.

Mo., Ferguson—Universal Match Co., A. H. Rosenberg, Pres., will soon receive bids for the construction of a 2 story match factory at Short St. and Wabash Ry. Estimated cost $85,000.

Mo., St. Louis—Bd. of Education, 911 Locust St., will receive bids until Apr 2, for the construction of first unit of vocational school including manual training shops, etc., at Bell, School and Channing Sts. G. W. Sanger, Acting Bldg. Comr. Noted Feb. 20.

Mo., St. Louis—W. N. Brown, 5100 Farlin Ave., will build a 2 story, 130 x 210 ft. steel plant at 1717 North 25th St. Estimated cost $50,000. Work will be done by owners forces.

N. H., Laconia—Scott & Williams, Inc., manufacturers of knitting machinery, awarded contract for the design and construction of a 4 story, 63 x 270 ft. factory.

N. J., Bordentown—State Bd. of Education, awarded contract for the construction of a trades building at Manual training and Industrial school, here. Estimated cost $121,528.

N. J., East Orange—Essex Co. Mortgage Co., 364 Main St., is havinb preliminary plans prepared for the construction of a 2 story garage, etc. at North Union Ave. and Commonwealth Pl. Estimated cost $150,000. W. F. Bower, 437 Main St., Archt.

N. J., Elizabeth—John Skramovsky, 51 Dayton St., is having plans prepared for the construction of a 1 story, 50 x 100 ft. work shop at 10-12 South Spring St. Estimated cost $40,000. J. B. Beatty, 15 North Reid St., Archt. Noted Mar. 6.

N. J., Grantwood—Chapman Chevrolet Co., 604 Anderson Ave., awarded contract for the construction of a 2 story garage. Estimated cost $150,000.

N. J., Newark—P. B. West, 24 Commerce St., Archt., will receive bids about Mar. 15, for a 2 story factory at Maple Pl. for General Alloy Co., 188 New Jersey Railroad Ave. Estimated cost $40,000. Noted Mar. 6.

N. J., Newark—Newark Special Tool & Machine Co., 51 Lawrence St., is having plans prepared for the construction of a 1 story, 90 x 110 ft. factory at 87-95 St. Francis St. Estimated cost $40,000. M. B. Silberstein, 964 Broad St., Archt. Noted Mar. 6.

N. J., Toms River—Industrial Institute c/o J. Rosbloom, 26 Court St., Brooklyn, N. Y., awarded contract for an industrial school including machine and repair shops, etc., here. Estimated cost $2,000,000. W. S. Schneider, 1775 Broadway, New York, N. Y., Archt. and Engr.

N. Y., Brooklyn—H. Baron & Co., 80 Metropolitan Ave., is receiving bids for the construction of a garage, etc. on Metropolitan Ave. Estimated cost $40,000. Shampan & Shampan, 188 Montague St., Archts.

N. Y., Brooklyn—Mario Pope, 460 Sterling Pl., plans the construction of a 1 story, 100 x 200 ft. garage at Brooklyn Ave. and Rutland St. Estimated cost $40,000. J. T. Riggo, 17 Atlantic Ave., Archt.

N. Y., Brooklyn—Standard Oil Co. of New York, C. F. Meyer, Pres., 26 Broadway, plans the construction of a 1 story, 103 x 112 ft. garage, etc. at Ave. V and Flatbush Ave. Estimated cost $40,000. Private plans.

N. Y., Buffalo—Buffalo Foundry & Machine Co., Fillmore Ave., will soon award contract for the construction of a 1 story, 103 x 137 ft. addition to machine shop. Estimated cost $60,000. Reidpath & Wilson, Gerrans Bldg., Archts.

N. Y., New York—48th St. Studios, Inc., 729 7th Ave., plans to remodel building at 318 East 48th St. into garage. Estimated cost $50,000. Watson & O'Reilly, 11 East 44th St., Archts.

N. Y., New York—Rubel Coal & Ice Co., 937 Fulton St., Brooklyn, awarded contract for a 2 story, 96 x 125 ft. garage at 521 West 21st St. Estimated cost $150,000. Noted Jan. 30.

N. Y., New York—Two Hundred Five West 101st St. Corp., 52 Broadway, plans the construction of a 7 story, 75 x 100 ft. garage at 205 West 101st St. Estimated cost $150,000. W. Shary, 22 East 17th St., Archt.

N. Y., Pleasantville — Westchester Lighting Co., 9 South First Ave., Mount Vernon, will receive bids about Apr. 1 for the construction of a garage, service building, etc. here. Estimated cost $150,000. Private plans.

O., Cleveland—Hammond Mfg. Co., G. M. Allen, Pres., 7808 Kinsman Rd., awarded contract for a 1 story, 75 x 124 ft. factory at 3889 East 80th St. Estimated cost $50,000. Noted Dec. 12.

O., Cleveland—Osborn Mfg. Co., E. H. W. Hopp, Const. Mgr., 5401 Hamilton Ave., brush manufacturers, awarded contract for the construction of a 1 story machine shop. Estimated cost $40,000. Noted Mar. 6.

Pa., Farmers Valley (mail Smithport)—McKean County Refining Co., W. H. Rockman, in charge, awarded contract for the construction of a group of buildings including 2 story, 50 x 120 ft. barrel house, 1 story, 65 x 72 ft. wax house, 2 story, 50 x 200 ft. shop building and 24 x 38 ft. office, etc.

Pa., McKeesport—Bd. of Education, Dr. J. B. Richey, Ariel Bldg., plans the construction of an industrial school. Estimated cost $600,000. Architect not selected.

Pa., McKeesport — Firth Sterling Steel Co., L. J. Firth, Pres., will soon award contract for the construction of a 2 and 3 story, 50 x 120 ft. experimental laboratory building. United Engineers & Constructors, Inc., Broad and Arch Sts., Philadelphia, Engrs.

Pa., Meadville—The Hookless Fastener Co., L. Walker, Pres., East Arch St., will soon receive bids for the construction of a 3 story, 50 x 70 ft. factory. Wilbur Watson & Associates, 4614 Prospect Ave., Cleveland, O., Archts. and Engrs.

Pa., Neville Island—American Tubular Elevator Co., 4700 Second Ave., Pittsburgh, awarded contract for the construction of a 1 story, 65 x 180 ft. factory on Grand Ave. here. Estimated cost $40,000.

Pa., Pittsburgh—Hicks Bros., Falls Creek, had plans prepared for the construction of a 1 story, 89 x 189 ft. garage and service station here. W. H. Overdorf, 23 West Long St., DuBois, Archt.

Pa., Pittsburgh—W. E. Moore (mechanical engineer electric furnace builders), 32nd St., is receiving bids for the construction of a 3 story factory at 32nd St. and Putney Way. Estimated cost $100,000. Private plans.

Pa., Reed—Standard Oil Co. of Pennsylvania, Peoples Gas Bldg., Pittsburgh, awarded contract for the construction of a relay terminal including 28 x 48 ft. tool house, 57 x 63 ft. garage and office, etc., here. Private plans.

Pa., Titusville—Titusville Iron Works, J. T. Dillon, Sr., Pres. and Gen. Mgr., will soon receive bids for the construction of a 1 and 2 story, 50 x 150 ft. foundry. Estimated cost $200,000. Private plans.

Pa., Wilkinsburg—J. Boyd, 1208 Center Ave., awarded contract for a 1 story, 50 x 180 ft. garage, and automobile cleaning plant at Penn. Ave. and Hay St. U. S. Motor Service Co., C. T. Garrison, Pres., 5711 Baum Blvd., Pittsburgh, lessee. Noted Feb. 27.

Tex., Sweetwater — International Harvester Co., W. D. Price, Supt. of Const., Harvester Bldg., Chicago, Ill., awarded contract for a 1 and 2 story, 100 x 183 and 100 x 300 ft. factory here.

Ont., Ottawa—Armstrong-Siddeley Co., England, plans the construction of a factory for the manufacture of airplane engines, air and sea planes at Britannia here. Estimated cost $1,000,000. Ottawa Car Mfg. Co., Ottawa, Agent.

Ont., Toronto—Bd. of Education, plans a 3 story addition to Central technical school at Harbard and Leppincott Sts. Estimated cost $150,000. C. Dyson, 155 College St., Archt.

Que., Montreal—Canadian Copper Refinery, Inc., subsidiary of Nichols Copper Co., 25 Broad St., New York, N. Y., will receive bids late in spring on construction and equipment for copper refinery here. Estimated cost $2,000,000. Private plans.